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TABLE OF CONTENTS PAGE 33

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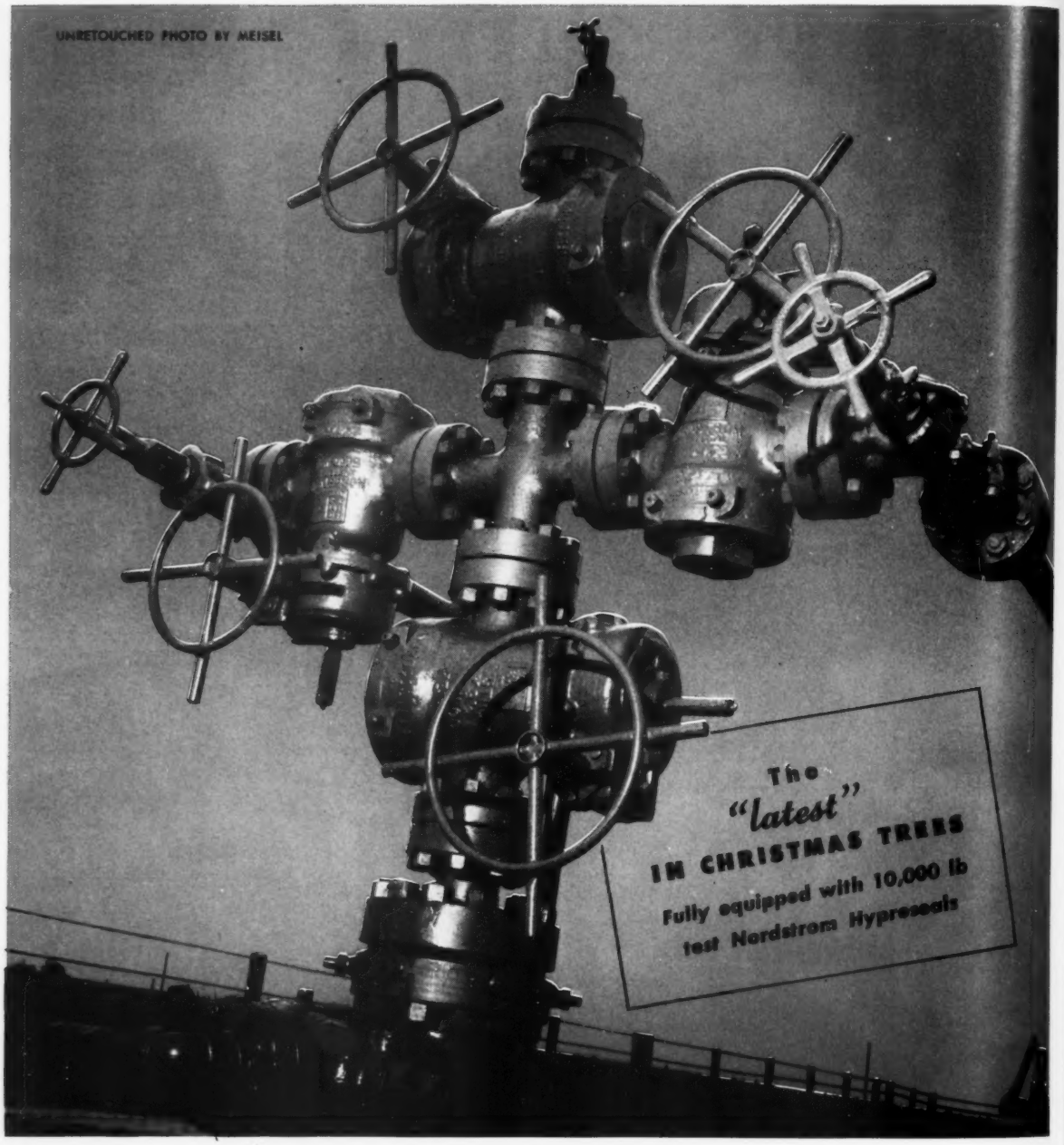

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Table of Contents

NEWS DEVELOPMENTS

5,000,000-Bbl. Production Rate Needed, Economists Report ... 36
Texas Eastern Takes Over Big Inch Pipe-Line System ... 38
February Imports Drop to 480,446 Bbl. Daily ... 38
New Conditions Bring Problems for Natural-Gasoline Industry 40
Industry Planning Needed to Meet Demand, Majewski Says ... 42
Government Corporations Continue Control in Japan ... 45
Letters Show Moffett Suggested Expropriation to Arabian King 51
United Proposes Service for Southeastern Area ... 51
Advertising Campaign to Carry Industry's Story to Public ... 57
A.P.I. Board Adds Four Marketers to Board of Directors ... 145

Editorial ... 35
This Week ... 39
International News ... 43
Watching Washington ... 47
Refining News ... 111
Pipe-Line News ... 114
Natural-Gas News ... 119
Natural-Gasoline News ... 119

NATURAL GAS MEETING SECTION

Natural-Gas Industry Headed for New Records ... 58
Gas-Turbine-Driven Centrifugal Compressors in Gas Lines ... 59
Report on Pipe-Line Flow ... 63
Spotting Pipe-Line Troubles at 100 Miles Per Hour ... 64
Operating Experiences with Angle-Type Compressors ... 67
Well-Head Price Fixing ... 71

ENGINEERING AND OPERATING

Stopgap Processes versus Catalytic Cracking ... 76
Safe Field Practices—Accident-Frequency Rates ... 83
Gas Injection Below Normal Gas-Water Contact ... 84
Oil Production by Water—Part 19 of a Series ... 90
Carbon Black Faces Progressive Changes ... 94
Questions on Technology ... 99
Developments in Drilling-Mud Control ... 101
Modern Rotary Drilling—No. 18 in a Series ... 105
The Refiner's Notebook—No. 142 in a Series ... 107
Engineering Fundamentals—No. 284 in a Series ... 109

EXPLORATION AND DRILLING

New East Texas Condensate Discovery ... 121
Reports by Areas Start on Page ... 121
Daily Average Production for Week ... 136
Daily Well-Completion Record ... 137

ADDITIONAL FEATURES

Personals ... 54
Deaths in the Industry ... 57
Drilling Contractors ... 133
Market Summary ... 138
Equipment Men in News ... 140
Classified Advertising ... 143
Calendar of Events ... 146
Advertisers' Index ... 146

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A Transportation Problem

REPORTS presented at Interstate Oil Compact Commission and National Petroleum Council meetings last week are in agreement that the petroleum industry is assured record demands over the remainder of the year that will be 6 to 8 per cent greater than in 1946.

This development in effect means that the domestic output of fields and refineries, exclusive of natural-gasoline and associated operations, must shortly be increased to 5 million barrels daily, with further increases necessary later in the year. The job of the next several months is not only to supply the peak motor-fuel needs of the summer season, but also to get ready for the still greater demands of the winter months.

As operators study their individual and collective problem of supplies they find that solutions in most cases are dependent on adequate transportation facilities. Managements have realized that the present situation was in the making since the close of the war and have endeavored to do something about it. Several projects would be further along than they are if prompt shipment of pipe and equipment had been possible over the past 18 months.

Now the industry is confronted with making the best possible use of what it has while construction programs are completed. Failure to do that may mean shortages of some products in important consuming areas.

Pipe lines are the industry's most important transportation arm. Some increase over present deliveries is possible by securing the maximum coordination in movements from the fields and deliveries to refineries. The same coordination will be necessary in the operation of product lines.

Additional tanker movements of both crude oil and products are largely dependent on cooperation from the Government, whose continued heavy demands for petroleum products in this country and elsewhere account in large measure for the tight oil markets everywhere. Tanker movements can be speeded up, and a better handling of the U.S.-owned tankers through sale or charter to private operators is basic in supplying new markets.

Waterways will have to be used as never before in inland shipments of petroleum. Rail movements, which played a major role in domestic oil deliveries during the war, will be of vital significance in supplementing the operations of all transportation media. Investigations have shown that rail and inland water movements can be increased substantially by shortening turn-around time and ending other unnecessary delays.

This program will increase expenditures because it involves a greater use of the more costly methods of transportation. But regardless of costs this industry cannot afford to have shortages in its peacetime markets. Wholehearted cooperation of all divisions of oil activity and the state regulatory bodies is mandatory.

PETROLEUM—A *PROGRESSIVE* INDUSTRY

State geologists at quarterly meeting, Interstate Oil Compact Commission, Birmingham, April 24-26: Walter B. Jones, Alabama; Paul Price, West Virginia; R. R. Spurrier, New Mexico; and Garland Peyton, Georgia

5,000,000-Bbl. Production Rate Needed, Economists Report

by C. O. Willson

BIRMINGHAM, Ala. — Crude-oil producers and refiners in the United States will have to maintain field and plant production at an average rate of at least 5,000,000 bbl. daily over the next year, according to reports presented by two economics committees from the industry at the spring quarterly meeting of the Interstate Oil Compact Commission here April 24-26. The reports were compiled by the economics advisory committee of the commission and by the supply and demand committee of the Independent Petroleum Association of America.

H. B. Fell, vice chairman of the I.P.A.A. committee, in presenting its report frankly conceded that the demand projection for this year made in late 1946 was far too low, explaining, "Without exception the forecasts prepared 3 or 4 months ago by this committee and by the recognized authorities such as the Bureau of Mines, the economics committee of the Interstate Oil Compact Commission, and many individual industry economists, failed by the large margin of 400,000 to 600,000 bbl. daily to anticipate this rate of oil consumption."

The two reports compiled separately and summarized in the accompanying tables are in substantial agreement as to demand but differ somewhat as to how the enlarged markets will be supplied. It will be noted in comparing the two projections that the total expected demands as projected by the I.P.A.A. committee are slightly greater than those of the compact committee. As to supply the most important difference in the two reports has to do with imports. The I.P.A.A. report forecast for the remainder of 1947 and the first quarter of 1948 assumes total imports will be at the average levels of 1946 or 370,000 bbl. daily. The compact committee projects imports ranging from 430,000 to 470,000 bbl. daily, the latter figure being the estimated imports for the first quarter of this year *(for February imports, see page 38.)* With the higher demand figures and the difference in expected imports the I.P.A.A. estimate of required domestic crude oil production for the third quarter is 100,000 bbl. daily higher than that of the compact committee and 200,000 bbl. daily higher in the final quarter.

Compact Projection

Dr. Richard J. Gonzales, chairman of the compact's advisory committee, in presenting the general report, emphasized the necessity of the state regulatory bodies keeping in mind that this country's peak demands now come in the winter months. Allowable production, he said, over the next several months should be increased to the end that there will be sufficient crude oil and product storage accumulations to supply the peak demands of the winter months, with special emphasis to be placed on the large consumption of intermediate products assured for the 1947-1948 winter period.

District 2

John Boatwright, economist of the Standard Oil Co. (Ind.) and a member of the compact's economics committee, briefly discussed the demand and supply outlook in District 2 which consists of the Middle West including Oklahoma and Kansas. Explaining that demands in this area will be at least 120,000 bbl. daily greater over the remainder of this year than they were for the comparable period in 1946 Boatwright said the required additional supplies were not available within District 2 and arrangements would have to be made to increase substantially shipments from other sources. This will involve increased storage facilities, the operation of refineries and pipe lines at capacity, and the speeding up of tank-car and barge deliveries over the next several months.

Eastern Area

A. J. McIntosh, Socony-Vacuum Oil Co., Inc., a member of the compact committee and chairman of the American Petroleum Institute statistical committee, made a similar report for the East Coast area. He explained that due in part to the exceptionally cold weather the petroleum demands in the East Coast area for the first quarter of this year were approximately 280,000 bbl. daily larger than they were the first quarter of 1946 but he estimated that for the entire year the eastern demands would be 170,000 bbl. greater than in 1946. McIntosh said that additional transportation facilities must be obtained to supply eastern demands this year. More tankers will be needed to move crude oil and products to the eastern states, and he suggested that arrangements be made to purchase or charter tankers now owned by the Government.

The opinion was expressed that the economic analyses would be of greater value to the industry if the reports could be broken down as to geographical areas. Robert Friedman, representing the Oil and Gas Division of the Department of the Interior, met with the compact officials, and a program was discussed which would make the reports available on a basis of the PAW divisions of the war period. It was also suggested that the reports be released just before meetings of the National Petroleum Council in Washington.

Compact Sessions

Approximately 150 members of the Interstate Oil Compact Commission

SUPPLY AND DEMAND FORECASTS

ECONOMICS COMMITTEES, INTERSTATE OIL COMPACT COMMISSION AND INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA
(Figures in 1,000 bbl. daily except as noted)

COMPACT COMMISSION, 1947 FORECAST

	1st quarter	2nd quarter	3rd quarter	4th quarter	Year	Actual 1946
Demand—						
Gasoline	2,015	2,380	2,420	2,255	2,267	2,138
Kerosene	395	240	215	350	300	268
Distillate fuel oil	1,110	700	610	960	845	746
Residual fuel oil	1,540	1,355	1,265	1,450	1,403	1,333
Other	790	900	960	890	885	836
Total demand	5,850	5,575	5,470	5,905	5,700	5,321
Supply—						
Crude production	4,780	4,950	5,000	5,000	4,932	4,749
Natural gasoline	345	350	355	365	355	321
Imports	470	430	440	460	450	370
Total supply	5,595	5,730	5,795	5,825	5,737	5,440
Stock change	—255	155	325	—80	37	119
Crude runs to stills	4,840	4,980	5,015	5,055	4,972	4,740
Closing stocks (million bbl.)	484	498	528	521	521	507

I.P.A.A., PRELIMINARY, FIRST QUARTER, 1947, AND YEAR ENDING MARCH 31, 1948

	Prelim.	Forecast				
	1st quarter	2nd quarter	3rd quarter	4th quarter	Average year	1st quarter
New supply—	1947	1947	1947	1947	1947	1948
Crude prod.	4,770	4,940	5,100	5,200	5,005	5,200
Nat. gasoline and benzol	340	340	350	350	345	360
Imports, crude and products	490	*370	*370	*370	400	*370
Total	5,600	5,650	5,820	5,920	5,750	5,930
Demand—domestic and export—						
Gasoline	2,050	2,380	2,490	2,320	2,310	2,200
Kerosene	400	250	230	350	310	420
Distillate fuel oil	1,100	700	690	930	850	1,200
Residual fuel oil	1,500	1,350	1,300	1,450	1,400	1,500
Others	800	880	960	870	880	810
Total	5,850	5,560	5,670	5,920	5,750	6,130
Closing stocks (totals)—						
Gasoline (fin. and unfin.)	107,400	95,000	85,000	94,000	94,000	106,000
Kerosene	9,500	15,000	18,000	17,000	17,000	11,000
Distillate fuel oil	32,600	41,000	60,000	57,000	57,000	35,000
Residual fuel oil	43,400	49,000	55,000	52,000	52,000	49,000
Others	64,000	65,000	64,000	62,000	62,000	63,000
Total products	256,900	265,000	282,000	282,000	282,000	264,000
Gasoline-bearing crude	228,000	228,000	225,000	225,000	225,000	225,000
Grand total	484,900	493,000	507,000	507,000	507,000	489,000

*Included at 1946 average rate. Changing this import level would require an offsetting change in U. S. crude production to balance demand.

and their advisors and representatives of oil companies attended the meeting here. Because many legislatures are in session it was impossible for several governors to attend. The membership and guests in the first meeting of the compact in Alabama were welcomed by Gov. James E. Folsom. The governor was host at a banquet April 25 at the Mountain Brook Country Club preceded by a fellowship hour given by Southern Natural Gas Co., Birmingham. Hiram W. Dow, who has been active in compact activities from its organization in 1935 and is now chairman, presided at the sessions. Earl Foster, executive secretary; E. G. Dahlgren, assistant secretary; and Arthur Davenport, assistant to the executive secretary, were in charge of meeting arrangements.

Nelson Lee Smith, chairman, and Harrington Wimberly, member of the Federal Power Commission, attended the meetings as observers, and Smith spoke briefly at a session devoted to the revisions to the Natural Gas Act now proposed in bills pending before the Senate and House of Representatives at Washington. At this meeting Rex Baker, general counsel of Humble Oil & Refining Co., and others strongly supported the position of the oil and gas industry given in detail at the recent hearings on the Rizley bill. This bill provides amendments to the Natural Gas Act to make clear that the Federal Power Commission has no controls over the production and gathering of natural gas and its end uses. Doubt was expressed that the Rizley bill would be passed in its present form.

Public Relations

John P. Morgan, Sun Oil Co., Dallas, vice chairman of the District 3 oil-industry public-relations committee, explained developments in the oil industry's public-relations program approved late in 1946 and now under way in several areas through organizations representing the oil industry and allied activities. Fred F. Murray, president of Oil Well Supply Co., Dallas, and chairman for District 3, and Don Riddle, Houston field representative, conferred with public-relations officials and others in the district during the meeting.

"The oil industry is one of the most progressive and competitive industries in this country," Morgan said. "During the recent war the products the oil industry through its workers and the products made available to the Allied military machine contributed substantially toward the winning of that conflict. But oil men generally recognize that another kind of war is still going on—you might call it the war of intangibles. This war has to do with attacks on the institution of private rights and property, civil liberties, and personal freedom. We believe that we owe an obligation to the public to give the constructive facts about our industry."

All of the 10 standing committees of the compact met during the 3-day meeting. Representatives of most of the 20 oil states presented brief reports on oil and gas activities in their states over the past quarter. These reports and those of the standing committees revealed the wide progress in secondary recovery and the reduction of gas wastage. Several states reported progress in the reduction of gas wastage through the installation of natural-gasoline plants and the disposal of residue gas either as fuel or for oil recovery operations.

Conservation in Texas

Jack K. Baumel, chief engineer of the Texas Railroad Commission, explained that since the "show cause hearings" held by the state commission last year on the wastage of casinghead gas a number of plants have either been built or are building or planned for later construction. Summarizing the accomplishments in his state, Baumel said:

"As to this date, 19 plants have been completed in Texas; 9 plants are at present being built and will be completed before January 1948; and 39 plants are in the planning stage and will probably be constructed before 1949. Completion of these plants should eliminate the wastage of some 760,000,000 cu. ft. of casinghead gas per day that is now being flared to the air; of this amount, it is estimated that 452,000,000 cu. ft. will be used in transmission lines for light and fuel, leaving 308,000,000 cu. ft. available for injection into oil reservoirs for pressure maintenance. The 19 plants already completed have stopped the wastage of 177,300,000

(Continued on page 145)

Texas Eastern Takes Over Big Inch Pipe-Line System

TEXAS EASTERN TRANSMISSION CORP. early this week was prepared to take over from Tennessee Gas & Transmission Co. operation of the Big Inch system, 2,815 miles of 24 and 20-in. line, for transmission of natural gas from Texas to the East Coast.

As final preparations were completed for the shift in management, plans for new construction of facilities to feed the system and to distribute its gas were announced.

In Dallas, Rogers Lacey, independent operator, said a survey will begin immediately for two proposed pipe lines to tie into the Big Inch and a natural-gasoline plant to extract liquids from the gas. Lacey said plans call for a 16-in. line from the Carthage area in Panola County to Longview, Tex., to cost $1,500,000, a 12-in. line from the Waskon area in Harrison County to Jefferson, to cost $750,000, and an East Texas gasoline plant to cost $1,500,000. Work on the projects, he said, will begin as soon as materials are available.

Supply from United Approved

In the gas-supply picture, FPC authorized United Gas Pipe Line Co. to sell gas to Texas Eastern for a period of 9 months beginning at the time the system is taken over by the latter company on May 1.

The gas would be delivered from United's Carthage-Sterlington line at a point in Bienville Parish, Louisiana, where the line crosses the Little Big Inch. United proposes to sell only such gas as it has available after fulfilling all other commitments from the Carthage-Sterlington line.

In Washington, the Federal Power Commission announced receipt of an application from New York State Natural Gas Corp. for authority to build a compressor station and connections where the Big Inch system and New York State Natural's line cross in Greene County, Pennsylvania. The company asked a temporary authorization to commence construction immediately on the $1,215,785 project.

FPC also announced United Natural Gas Co., Oil City, Pa., has filed an application asking authority to extend its pipe-line facilities to receive supplies from the system. Proposed were a 71-mile, 20-in. line from the company's 12-in. line in Beaver County to cost $3,737,718.

In Wilmington, Del., President Stuart M. Crocker told stockholders of Columbia Gas & Electric Co. two operating subsidiaries of the company have contracted with Texas Eastern for delivery of up to 150,000,000 cu. ft. of natural gas daily from the system.

Equitable Gas Co. announced in Pittsburgh the signing of contracts calling for delivery of 30,000,000 cu. ft. daily from the Big Inch lines. At present the company is receiving 15,000,000 cu. ft.

The Big Inch system is made up of the 1,340-mile 24-in. line from Longview, Tex., to the New York-Philadelphia refinery area and the 1,475-mile 20-in. line from the Texas Gulf Coast refinery area to the New York area.

Built at a cost of $145,800,000 early in the war to transport petroleum products to the East Coast, the lines were purchased by Texas Eastern for $143,127,000. But by the time the company was scheduled to take over, the lines in postwar service already had transported about 17 billion cubic feet of natural gas to the Appalachian area under the management of Tennessee Gas & Transmission Co.

Unable to secure materials in time to increase the capacity of its own pipe line for the winter, T. G. & T. on December 2, 1946, obtained the oil lines from the Government on a 4-month lease basis during the coal strike. Gas was turned into the Little Big Inch line for the first time at Many, La., December 5. On December 11 it was being delivered in commercial quantities to consumer points in Ohio.

$1,000,000 Rental Paid

During the 4-month period, according to Gardiner Symonds, Tennessee president, the company paid War Assets Administration more than $1,000,000 in rental and saved the government agency about $300,000 in maintenance costs.

With steel pipe and other materials now more readily available, Symonds said, Tennessee's program of laying a parallel line to the Appalachian area is well under way in seven states, and a large part of the construction program is expected to be completed before next winter. The company has an application pending before FPC to further increase the capacity and, if granted, will allow Tennessee to push 600,000,000 cu. ft. of gas daily through its own system, Symonds said.

During the time it was operated by Tennessee, he added, flow of gas was only 75 per cent efficient because of large quantities of condensed moisture in the line. Designed to pump oil, much work was required for the transmission of natural gas. Symonds said the company paid an average of 6 cents per 1,000 cu. ft. for gas used in the system, indicating that more than $1,000,000 went to producers and land and royalty owners in the Southwest.

Temporary offices of Texas Eastern have been established in Shreveport, La., with main branches in New York and Houston. R. H. Hargrove will serve as vice president and general manager and E. R. Cunningham will be general superintendent.

February Imports Drop To 480,446 Bbl. Daily

ALTHOUGH the United States continued as a net importer of petroleum in February, import figures for the month showed that the gap was considerably narrowed with a decline in imports and a gain in exports.

The following table is based on preliminary tabulations of the Bureau of the Census.

Imports, January and February 1947

Petroleum liquids (in barrels)	January	February
Crude petroleum	9,309,139	8,408,163
Gasoline	55,400	55,529
Gas oil, distillate fuel oil	611,025	325,503
Residual fuel oil	5,914,216	4,651,279
Unfinished oil	59,918	3,558
Other petroleum liquids	7,189	8,469
Total liquids (in bbl.)	15,956,887	13,452,496
(Barrels daily)	514,738	480,446
Other petroleum products—		
Paraffin wax, lb.		322
Petroleum jelly, lb.	115	6
Petroleum asphalt, long tons	10,764	19,055
Total other (in long tons)	10,764	19,055

Exports, January and February 1947

Petroleum liquids (in barrels)	January	February
Crude petroleum	2,528,853	2,610,370
Natural gasoline	320,837	201,219
Aviation motor fuels	80,766	381,531
Other motor fuels	2,454,200	4,224,632
Kerosene	394,475	930,416
Gas oil, distillate fuel oil	876,475	1,751,101
Residual fuel oil	733,416	712,662
Lubricating oil	1,103,737	1,258,105
Other petroleum liquids	30,742	21,829
Total liquids (in bbl.)	8,523,501	12,091,685
(Barrels daily)	274,952	431,846
Other petroleum products—		
Lubricating greases, lb.	10,185,710	10,297,068
Petroleum jelly, lb.	8,338,163	9,868,095
Liquefied petroleum gases, lb.	24,900,003	21,764,959
Paraffin wax		
Unrefined, lb.	8,332,470	10,219,440
Refined, lb.	18,789,394	13,982,607
Petroleum asphalt, long tons	45,892	43,737
Petroleum coke, long tons	24,477	25,433
Total other (in long tons)	101,863	98,685

this week

SUPPLY AND DEMAND—Continually mounting demand for petroleum products, now approaching the limit of production facilities, becomes a subject of increasing concern. . . . Economics committees of Interstate Oil Compact Commission, I.P.A.A. submit forecasts each estimating that an unprecedented 5,000,000-bbl. production rate will be required over the coming year. . . . I.P.A.A. report prefaced by statement by H. B. Fell, chairman, pointing out that virtually all authorities failed "by the large margin of 400,000 to 600,000 bbl. daily to anticipate this rate of oil consumption." . . . ¶National Petroleum Council undertakes comprehensive study of all phases of supply problem but turns down any crude or products allocation plan after agenda committee warns it could be contrary to law and also contrary to American competitive system. . . . Individual council members express belief only local and temporary shortages will develop. . . .

NATURAL GAS— United Gas asks FPC approval of proposal to build $57,126,000 system extending through Alabama, Georgia, northern Florida, and into southeastern South Carolina. . . . Project would be carried out by a yet-undesignated United subsidiary. . . .

MARKETING— Buyers search markets for supplies. . . . Talk of shortages intensifies efforts of purchasers. . . . Market hears talk of further rises in products prices, particularly gasoline, and possibly another crude increase. . . . Some refiners reported allotting residual fuel oil on a 70-90 per cent basis, while spot market sales of this material continue to bring prices ranging around $1.95. . . .

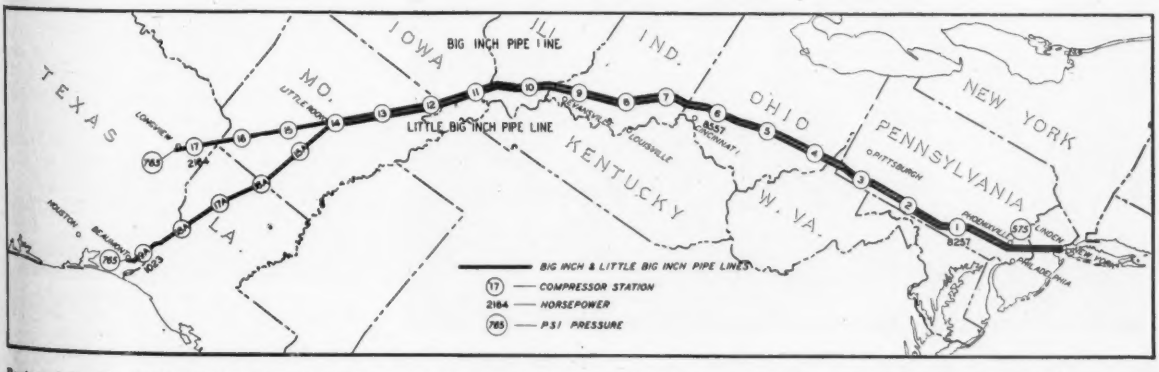
REFINING— Crude shortage forces shutdown of Panhandle Refining's Wichita Falls plant, but officials announce reopening May 1. . . . ¶Second refining company, Premier Oil Refining, asks Texas Railroad Commission approval of multiple-car rate plan. . . . Company asks lower rates on such shipments from Chautauqua to Fort Worth. . . . ¶WAA announces sale of government-owned refining facilities at El Dorado, Ark., to Root Petroleum, the wartime operator . . . ¶Bay Petroleum contracts for construction of 1,000 bbl. reformer unit at McPherson, Kans., refinery. . . . ¶Texas City oil and chemical companies begin making plans for reconstruction of property lost in the disastrous April 16 explosion. . . . Monsanto Chemical, hardest hit, estimates styrene plant may be back in production in 6 months. . . .

PIPE LINES—Utah Oil Refining announces plans to construct 200-mile 10-in. crude line from Rangely field to Salt Lake City. . . . Completion planned in 1948; capacity to be 24,500 bbl. daily. . .

GOVERNMENT-INDUSTRY— Walter Hallanan, N P C chairman, makes statement declaring House appropriations committee report cutting funds for OGD and other Interior Department agencies indicated "serious misconceptions" of OGD's services to the industry. . . . Makes clear that NPC members are serving as a public duty and that OGD was not created at industry's request, also asserts committee has permitted "someone to 'smear' the industry." . . .

BIG INCH— Big Inch system passes to private ownership. . . . Tennessee Gas & Transmission prepares to relinquish lines to successful bidder, Texas Eastern Transmission, which has been given temporary authorization by FPC to operate the system for gas movement pending conversion and the filing of an application for permanent operation. . . .

EXPLORATION— Standard of Texas completing important gas-distillate well in Cherokee County, Texas, estimated open-flow capacity, 147,000,000 to 170,000,000 cu. ft. and 500 bbl. daily from Rodessa at 8,608-30 ft. . . . ¶Gasoline Production Corp. discovery in Yoward area, Bee County, Texas, makes flowing potential of 165 bbl. 41.2°-gravity oil through perforations at 7,483-93 ft. . . . ¶Union Oil opens third pool in Madison formation, Cut Bank field, Montana, with biggest well in area, making 365 bbl. oil daily from 3,030-80 ft. . . .



Routes of the Big Inch and Little Big Inch lines are shown in this map. Numbers on the lines indicate proposed natural-gas compressor stations. Circled figures at Beaumont and Longview are input pressures in psia. and figure at Phoenixville is the delivery pressure. *(See story on opposite page)*

D. E. Buchanan, independent natural-gasoline operator, was the moderator for this panel of engineers and technologists who answered practical and important questions for the assembled convention registrants. Panel members, left to right, are Z. C. Ambrose, Chicago Corp.; G. G. Brown, University of Michigan; Max Riley, Anco Gas Corp.; B. L. Spain, Ingersoll-Rand Co.; Walter D. Scheumann, Cities Service Oil Co.; Henry Bogess, Sinclair Prairie Oil Co.; M. W. Kibre, General Petroleum Corp.; G. W. McCullough, Phillips Petroleum Co.; A. J. Kerr, Pittsburgh Equitable Meter Co.; Charles Miller, Midland Gasoline Co.; D. N. Barrow, Arkansas Fuel Co.; H. M. Nelly, Jr., Refining Maintenance Co.; and M. H. Roths, Brown & Root, Inc.

New Conditions Bring Problems For Natural-Gasoline Industry

by Arch L. Foster

DALLAS.—The natural-gasoline industry took a widening look at its problems and prospects and found more good than bad in the picture as the Natural Gasoline Association of America carried through its twenty-sixth annual convention here April 23-25.

Studying its technical as well as economic problems, the assembled gasoline men found that conservation of gas and correlated raw materials is progressing rapidly under the direction of industrial and governmental forces, looking to a common end. The motor and aviation-fuel industries are changing rapidly under the impetus of wartime and postwar technical and economic developments. Motor-fuel specifications and practices are changing with changing refining operations, and the effect may have both good and bad features for the natural-gasoline industry, they said at the meeting.

Motor-fuel road tests carried out carefully have shown that the refining industry can absorb more natural gasoline than has been the case heretofore, with profit to both industries. Long strides in the solution of the problems of high-pressure condensate-line corrosion problems were reported and the methods used to solve the problems in various instances were outlined.

Changes in the motor-fuel picture are complicating the situation but the final result will be more and better motor fuels, eminent refining technologists told the meeting. It is much simpler for the oil industry to change the specifications and design of its motor fuels than it is for the automotive industry to face about in its engine designs, the meeting was told by the director of research for Ford Motor Co., Dr. W. S. James.

It must be the hope of the industry that the future will bring competitive prices and a steady flow of natural-gasoline products into the over-all petroleum-products picture, said retiring association president, J. H. Dunn, in summing up the position of the industry. The extremely wide fluctuations of price has prevented the building of many plants, he said, and the same situation has forced other plants into premature abandonment.

Thermal and Cat Cracking

The 8-fold increase in motor-fuel production in 30 years is due almost entirely to introduction of thermal and catalytic-cracking processes, W. M. Holaday and collaborators, of Socony-Vacuum Oil Co., Inc., technical staff, told the gasoline makers. Catalytic-cracking capacity increased 10-fold during the war, Holaday stated, and now produces about 18 per cent of our total motor and aviation-fuel supply, or about 35 per cent of all cracked gasoline stocks. The fact that catalytically cracked gasoline is high in octane rating in its heavy ends while thermally cracked gasoline in its upper distillation bracket is low in antiknock will induce refiners to add more high-boiling material which will tend to decrease fuel volatility, Holaday indicated. This tendency may be offset by adding more natural and other light ends to balance the volatility, which may result in greater consumption of natural and a stabilization of prices and markets, it was brought out. The object of several major motor-car makers appears to be to build cars for fuels of A.S.T.M. ratings of about 85, Holaday said, and with research ratings of around 95, or a

New N.G.A.A. officers are: William F. Lowe, Tulsa, secretary-treasurer; James E. Pew, Sun Oil Co., Philadelphia, vice president; C. R. Williams, Chicago Corp., Corpus Christi, Tex., president; and Albert H. Weil, United Gas Pipe Line Co., Shreveport, and Henry M. Brown, Midland Gasoline Co., Houston, vice presidents

"spread" between the two ratings of around 10 numbers.

Production of motor fuels with needlessly high octane ratings is contrary to the conservation principles adopted throughout the oil and gas industries, Ernest O. Thompson, chairman of the Texas Railroad Commission, stated in making a strong appeal for conserving hydrocarbon resources by improving yields and mileage returns. "The best conservation program," Thompson said, "is the one which will give the most miles per barrel or per pound of crude."

Returns to the consumer for large-octane-number increases is not great enough to warrant the cost and the loss in over-all yield, he indicated, pointing out that in the technical literature much data show that by boosting octane ratings from 74 to 80 the total power increase is only of the order of 3 per cent. Refiners, Thompson said, "under the control of a 'magnificent obsession' for greater octane numbers now process perfectly good naphthas at a yield penalty of 20 to 30 per cent," a procedure which can cost the industry the consumption of more than 75,000,000 bbl. of crude. Simple improvements in distributor design, in spark-timing adjustments will enable us to reduce octane requirements by 5 to 15 octane numbers without noticeable reduction in mileage or power output. The optimum octane rating for passenger car fuels is about 65, Thompson indicated, and he insisted that the industry not penalize itself and the consuming public by incurring needless waste and yield losses for the "will-o'-the-wisp" of higher and higher octane ratings.

That the maximum Reid vapor pressure specification be raised from 13 to 15 lb. for winter motor fuels is the recommendation of the N.G.A.A. technical committee after study of the data obtained from the Nowata, Okla., road tests. These tests held early this year studied the performance of 16 cars, mainly 1942 and 1946 models, as to their reaction to two types of gasoline, one with 70 per cent evaporated at 212° F. and the other with 41.5 per cent evaporated at 212° F. It was found that for temperatures of 55° F. and below the cars operated satisfactorily with 15-lb. gasoline, that is, the maximum permissible Reid vapor pressure is slightly above that value. For 35° F. the maximum permissible vapor pressure proved to be 20.5 lb. and these values were correct for both fuels tested. The technical committee reported that its opinion is that winter fuels at 15 lb. are as safe from vapor-lock troubles as is conventional summer gasoline under summer conditions in the territory covered by the study.

Increasing Miles Per Gallon

Increasing to 50 per cent the natural-gasoline content of motor fuels will provide an outlet for 32,000,000 bbl. of 12-lb. natural, the committee stated. Under the present recommendation of 15 lb. for winter fuels in the geographical area under consideration, the Southwest, for the 3 winter months, an additional outlet for 5,000,000 bbl. (210,000,000 gal.) of normal butane is represented.

Several means are available for increasing the number of miles per gallon obtained from passenger cars of the future, Dr. W. S. James, director of research, Ford Motor Co., told the natural-gasoline men. Two of these methods, James said—supercharging and increase in compression ratio—are vitally affected by fuel properties. "The direction and speed of the commercial development in the automotive industry, of methods for increasing miles per gallon will be dependent upon the relation between fuel cost dollars saved and per cent increase in miles per gallon," James has decided. In studying the effect of change of several design variables on the miles per gallon of a car, the effect of a 0.72 to 1 overdrive is to increase the ideal mileage by 35 per cent at full throttle, and by 30 per cent the present possible increase in miles per gallon.

Reduction of wind resistance of a car, as indicated by a 25 per cent reduction in the product of the frontal area and the wind resistance coefficient, increases from zero at low speeds to 15 per cent at higher speeds. A 15 per cent decrease in weight of car varies widely, but the advantage may be obtained in better performance with the same engine or the same performance with a lighter, less powerful engine. Boosting the compression ratio from 6.5 to 1 up to 12 to 1 raises the thermal efficiency 23 per cent, James showed. Supercharging results in large gains in either engine speed or power savings or by reducing engine size for a given power. Automatic transmissions, not generally available commercially, also tend to make considerable improvements in efficiency because they tend to keep the engine operating at maximum efficiency at any load or speed.

Volatility All-Important

One of the greatest pieces of news in recent times is the information that catalytic cracking will produce

(Continued on page 132)

Officers and directors of the Natural Gasoline Supply Men's Association are shown in this group picture. Front row, left to right: J. H. Dunn, director; J. N. McClure, Elliott Co., Houston, treasurer; Roy Bush, Nordstrom Valve Division of Rockwell Manufacturing Co., first vice president; and J. A. Knebel, Hinderliter Tool Co., Tulsa, division of H. K. Porter Co., second vice president. Back row: Directors Warner Lewis; V. C. Canter, Jones & McLaughlin Supply Co., Tulsa; H. N. Rosevear, Wyatt Metal & Boiler Works, Dallas; Dallas Deem; L. D. McKay, Union Steam Pump Co., Tulsa; Cade C. Clover; Ray T. Roberts, Goulds Pumps, Inc., Tulsa; and L. L. Dresser. Not shown in the picture are William F. Lowe, secretary, and Walter D. Smith, Worthington Pump & Machinery Corp., Tulsa, director

Industry Planning Needed to Meet Demand, Majewski Says

WASHINGTON. — The rapid increase in demand for petroleum products and difficulties facing the industry in meeting it was the chief topic of discussion at the quarterly meeting of the National Petroleum Council here April 22.

All members agreed that the supply situation will be tight during the balance of the year and that the problem should be studied, but there were varying opinions on the degree of tightness, ranging from the fear that spot shortages will be severe, with dealers unable to fill all orders, to the prediction of one member that a general depression later this year will reduce consumption to the level of production.

Several members of the council, led by B. L. Majewski of Deep Rock Oil Co., demanded that action be taken immediately. This was the first time that any subject was initiated by the council itself, all others having originated with the Oil and Gas Division, but OGD joined in the request for action because of the difficulties of government agencies to obtaining adequate supplies at present.

Five Committees Named

Five committees were appointed to make factual studies and report as soon as possible on current production of crude and products, over-all facilities available for transportation, refining capacity, steel shortages, and government requirements. Some members wanted the council to go farther than this and to develop plans for allocating crude to refiners and products to dealers, but the agenda committee warned that "certain types of planning and concerted industry action are not only contrary to law but also contrary to the American system of a competitive economy which has made the oil industry in this country."

While some members urged that these committees report to a special meeting of the council within 30 days it is unlikely that such a session will be called, but the committee reports may be circulated to the membership before the date for the next quarterly meeting.

The supply situation occupied virtually the entire day's discussion, and little other business was transacted. Reports were received from committees on statistics, international standards for measurement of liquid petroleum fuels, petroleum rail transportation, and petroleum truck transportation.

Discussion of the supply situation was started by Majewski prior to the council meeting in a letter to Max W. Ball, director of the Oil and Gas Division, in which he said that "meeting the huge anticipated demands for petroleum is a must." He was chiefly concerned over the shift in demand to a larger proportion of distillate fuels, saying:

Distillate Demand Expanding

"The demand for distillate burning oils and diesel fuel is exptnding much more rapidly than is the demand for gasoline, currently the industry's principal revenue product, which is also in short supply as is residual fuel. With the variation in the rate of growth in demand for these products many problems of refinery operations incident to change of yields of the various derivative products from a barrel of crude oil, and problems relating to the adequacy of storage and distribution facilities for distillate fuels are now upon us.

"In a very real sense, this is the second time in its history that the oil industry has faced a shift in the demand for, and economic dependence upon, its derivative products. The first was a shift from a kerosene to a gasoline economy, and now we are witnessing a shift to an economy dependent jointly upon gasoline and distillate fuels. The growing requirements for distillates are now competing for an ever-expanding portion of the barrel of crude oil processed at the refinery. Consumers of distillates are competing with the gasoline market for supplies and choosing oil increasingly over coal and gas. Distillates are no longer a byproduct of refining in any sense of the word. They now rank as one of the major derivitives and are assuming a fast-growing economic significance.

New Diesel Equipment Mentioned

"In large and important segments of the country the oil industry has not been meeting fully this new combined demand during the past several months, and with the huge projected installation of oil-heating and diesel equipment during the next 24 months staring us in the face, we will not come close to meeting the demand without careful planning now."

Majewski's request for council action was seconded by Ball, who wrote that "the military have been able to obtain but a small fraction of their current requirements of petroleum products. An even more serious situation is said to exist with respect to forward military requirements, since many units of the industry, formerly suppliers of these requirements, have advised that they are unable to make any commitments whatsoever with respect to future supplies for the services." He added that the Bureau of Federal Supply has been able to cover only one-tenth of its mid-western requirements for petroleum products.

Military's 1947-48 Needs Placed at 90,000,000 Bbl.

WASHINGTON. — The Army and Navy will require some 90,000,000 bbl. of major petroleum products during the fiscal year beginning July 1, 1947, according to estimates presented to the National Petroleum Council by the Army-Navy Petroleum Board.

Major purchases will be 26,000,000 bbl. of Navy special fuel, 17,000,000 bbl. of other heavy fuel oils, 17,000,000 bbl. of Navy diesel oil, 8,000,000 bbl. of motor gasoline, and 8,000,000 bbl. of 100-octane aviation gasoline. About half the Navy special and Navy diesel will be purchased from foreign sources and about one-third of the motor gasoline, but most of the remainder will be sought in the United States.

Los Angeles, Tulsa Picked For A.I.M.M.E. Meetings

Fall meetings of the Petroleum Division, American Institute of Mining and Metallurgical Engineers, will be held in Tulsa, October 8-10 in the Mayo Hotel and in Los Angeles, October 23-24 in the Elks Club.

Lloyd Elkins, Stanolind Oil & Gas Co., Tulsa, has been named general chairman for the southwestern meeting, and Sam Grinsfelder, vice president, Union Oil Co. of California, will serve as chairman of the West Coast meeting. Programs are being prepared by a committee headed by Nico Van Wingen, Richfield Oil Co., Los Angeles, and H. J. Struth, editor of Petroleum Data Book, Dallas.

Clyde Williams, director of Batelle Memorial Institute, Columbus, Ohio, and recently installed as president of A.I.M.M.E. will visit southwestern local sections during week of May 12-17, accompanied by Wilber Judson, president of Texas Gulf Sulphur Co. and former institute vice president.

International

WORLD-WIDE OIL DEVELOPMENTS

Slightly Higher Production in 1947 Forecast in Creole Report

HAVING produced an average of 545,390 bbl. daily of crude oil in 1946, Creole Petroleum Corp. is "contemplating a slightly higher rate of production in 1947," Arthur T. Proudfit, president, reported in the company's 1946 annual report. Indicative of this forecast, Creole's February 1947 production averaged 599,192 bbl. daily.

Creole's 1946 crude-oil production, including purchased royalty oil, was 20 per cent higher than in 1945 and was 51.2 per cent of total industry production in Venezuela. Approximately 80 per cent of Creole's production, both new and old, is flowing from natural pressure, while 15 per cent is pumped and 5 per cent is being obtained by gas lift, Proudfit explained.

Of considerable interest to oil companies operating in Venezuela was the government's extraordinary one-time tax levied on 1945 income. This tax was incorporated into a revision of the Venezuelan income-tax law last year. The temporary element of the extraordinary tax, which was a 20 per cent levy added to the normal 12 per cent, was thereby replaced by a permanent maximum rate of 28½ per cent with certain discounts for reinvestment of capital. Consequently, Creole's 1946 operations netted the Venezuelan Government $80,083,234, compared with Creole's net profits of $83,305,686, or roughly 50 per cent.

Concerning the Middle East, Proudfit said "if Venezuela's oil is to maintain a strong competitive position under all market conditions, including those which may result from development of the Middle East as an important source of supply, it is essential that the recent rapid rate of increase in the cost of labor, material, and taxes in Venezuela be checked. This can only be done through the cooperation of all parties mutually interested in the development of Venezuelan production."

Proudfit pointed out that "our unit cost per barrel of oil increased 18 per cent over 1945 unit cost; this despite a 20 per cent increase in production which would ordinarily reduce unit cost and notwithstanding that our higher labor rates were effective only 7 months of the year."

Plans have been completed and a contract awarded for construction of a crude-stabilization and repressuring plant at Mulata, similar to the Jusepin plant. Construction of the Mulata plant will start as soon as materials and equipment are available.

Creole is participating in a new repressuring project in the Greater Oficina area, and San Joaquin and El Roble fields are being carefully studied to ascertain if crude stabilization and repressuring will be economical.

Creole's engineers initiated an experimental drilling technique last year, Proudfit said, particularly adaptable for over-water drilling in Lake Maracaibo. This is an integral rig made up of a combination derrick and substructure on which the draw works, engine, and rotary table, as well as auxiliary equipment, are permanently mounted and handled as one unit. This design is especially advantageous in that it can be moved by heavy barges as a single unit from one well location to another.

Andean Geology to Be Studied

IN a field trip which may be the forerunner to oil-industry development of the vast unexplored Montana region east of the Andes) in Peru, geologists from Columbia University, the American Museum of Natural History, and the Instituto Geologico del Peru, shortly will commence a 4-months study in the highest levels of the Andes Mountains.

The expedition will conduct scientific investigations and work closely with the following oil companies: Standard Oil Co. (N. J.), Gulf Oil Corp., Shell Oil Co., and Socony-Vacuum Oil Co., Ltd. A $22,000 research grant by these companies will make possible further graduate studies of two experienced geologists as members of the expedition. Important research work which it is hoped will have some direct bearing on the development of oil fields in the upper reaches of the Amazon River may result from this survey.

Dr. Norman D. Newell, professor of geology at Columbia and curator in the department of geology and paleontology at the American Museum, will head the expedition. Newell spent 3 years exploring the Andean region for the Peruvian Government during the war. The museum will be represented by Robert Adlington, specialist in the department of geology and paleontology. The two graduate students, who will work under university fellowships supported by the oil companies, are Thomas G. Roberts and John Chronic, both from Lawrence, Kans.

The trip will take the group up to altitudes between 10,000 and 17,000 ft. in the Andes region east and south of Lima between the Peruvian towns of Cuszco and Huancayo, Newell said. Fossil remains of marine life deposited in ocean muds when that region was covered by a Paleozoic sea will be studied. Because the geological structure of the Andes is an easily-read duplicate of conditions existing further eastward in the Amazon lowlands, the findings will be of aid to oil explorations now being conducted in the Amazon regions, Newell explained.

The expedition will fly to Lima on May 23. There they will be joined by a group of Peruvian scientists from the Instituto Geologico del Peru, under the direction of Dr. Jorge Broggi. After they have become accustomed to the high altitudes, they will carry on their explorations by jeep.

Bolivia Planning 22 Development Wells in Camiri Field

TWENTY-TWO development wells are expected to be spudded in Bolivia's Camiri field before the end of 1947, with an additional 28 wells planned for next year. South American Oil Development Corp. is the contractor for Yacimientos Petroliferos Fiscales Bolivianos (Bolivian Government Oil Fields).

Moreover, the same contractor is expected to spud in a wildcat in the Guayruy area near Camiri. Whether the Bolivian Congress approves a concession for Superior Oil Co.—which Y.P.F.B. has already approved—remains uncertain. However, well-informed sources believe that the concession will be granted.

South American Oil Development Corp. is also anxious to obtain Bolivian oil concessions, on its own, and conduct wildcatting operations. Another unnamed company reportedly is interested in Bolivian prospects.

Passage of the proposed new petroleum law for Bolivia by Congress is expected within the next few months. Once this law is passed, a certain degree of interest is expected to be developed by United States oil companies in Bolivian wildcatting.

The U. S. Department of Commerce reports that in deepening a well in the Camiri field—a well which had been abandoned as a dry hole in 1931 by Standard Oil Co. of Bolivia—Y.P.F.B. struck a new oil-bearing formation at 1,643 ft. As the well is about 2 miles from the producing wells in the Camiri field, it is generally regarded as proving a greater extension of the producing formation than had previously been estimated. Some engineers have stated that the new discovery more than doubles the the estimated reserves of this field.

Ogaden Area Considered Ethiopia's Most Favorable Prospect

SHOULD a daily crude-oil potential production of from 25,000 to 30,000 bbl. be developed, Sinclair Oil Corp. might consider it commercially advantageous to build a pipe line from the area in Ethiopia where the crude may be found to some coastal point.

Whether the deep-water outlet would be the Mediterranean, the Indian Ocean, or the Gulf of Aden will be entirely dependent on the daily potential, The Oil and Gas Journal has been told by an authoritative source.

On the basis of preliminary aerial and geological surveys, Ethiopia's Ogaden area, bounded on the north by Somaliland Protectorate and on the east and south by Italian Somaliland, seems the most favorable for sedimentary deposits. Other Ethiopian areas which may prove favorable, on the basis of current information, are in the north.

While Sinclair hasn't yet decided on the location for its first wildcat, indications are that the best sedimentary possibilities may be somewhere in the Ogaden area. Before this decision is made, however, additional aerial photographic surveys will be completed, backed up by aerial magnetometer work. Moreover, current plans call for the aerial photographic and aerial magnetometer surveys to be made from the same plane. To date, about 1,400 aerial photographs have been taken of various land areas in Ethiopia.

In addition to this work, company experts have been studying geological surveys made some years ago by Barnham Brown, who headed an Ethiopian geological expedition. Brown's reports are currenty being brought up to date. About two-thirds of Ethiopia's 350,000 sq. miles are covered by a lava deposit which varies in thickness.

In addition to the hopes of the Sinclair company and Ethiopia's Emperor Haile Selassie that commercial crude-oil production be obtained in that country, the U. S. State Department also is vitally interested as it would give United States nationals strategic petroleum reserves not far from the Middle East, yet far from the reaches of the Soviet.

If a crude-oil pipe line is ever constructed, say from some southern area in Ogaden, its length would be upwards of 1,600 miles. The currently projected Trans-Arabian 30-31.-in. pipe line is expected to be around 1,050 miles long.

In developing the Ethiopian area, the social and economic conditions reportedly will be more difficult to cope with than those encountered by any other oil company in any world area. "Civilization" arrived in Ethiopia thousands of years ago. A pattern has more or less been set. The Emperor who takes a personal interest in current oil exploratory activities is desirous of improving economic and social conditions.

If Sinclair finds oil in Ethiopia, the contract calls for the establishment of schools, hospitals, clinics, and research foundations, in addition to royalties to be paid the emperor. Moreover, the company is to finance an educational program for Ethiopians in the United States during the first 10 years of oil-industry operations in this eastern central African country.

Sinclair obtained the Ethiopian oil concession in 1945. Under terms of the concession, all petroleum-development rights for the entire country—equal in area to Texas, Oklahoma, Massachusetts, and Rhode Island—will rest with Sinclair for 5 years. Then 50 per cent of the area is to be released. After an additional 5-year exploratory period, 25 per cent more is to be released. The remainder will be under concession for 50 years.

Agreement Includes Refinery

If the volume of crude oil discovered justifies the construction of a refinery, this is to be done, according to the agreement between Sinclair and the Ethiopian Government. As to whether such construction will be economically sound is another factor, and one to be worked out at a later date.

In the event of the creation of an Ethiopian subsidiary by Sinclair, Ethiopian subjects are to be given a subscription preference up to at least 20 per cent of the stock. Regarding royalties the government reportedly will receive payment on a stipulated basis for the first 5 years and thereafter at an increased rate subject to revision in 15 years from the start of commercial crude-oil production.

Possibilities for a pipe-line terminus include Djibouti in French Somaliland, assuming that the Ogaden area proves commercially productive. At Djibouti a well-developed harbor has been constructed and is capable of handling ships up to a draft of 27 ft.

By the end of next year, or possibly before, Sinclair hopes to have completed its first wildcat, at an estimated cost of $1,250,000. *(For additional details, see The Oil and Gas Journal, April 12, page 60).*

Government Corporations Continue Control Of Petroleum Products in Japan

by Warren W. Burns

International
WORLD-WIDE OIL DEVELOPMENTS

This is the second of two articles dealing with the current status of the petroleum industry in Japan. The first, appearing April 19, page 70, discussed particularly the Japanese refining industry. This article summarizes the outlook in petroleum products distribution.

WITH the growing tendency on the part of Japanese authorities to look to petroleum to bridge the gap between coal production and estimated total fuel requirements, including fuel for steel and iron industries, plate glass, marine transport, and other needs the black market continues to hamper the economy of the country while petroleum and other commodities are in short supply.

Rationing has been ineffective. However, as the Japanese Government at long last is now taking corrective steps to overhaul the rationing system, the situation may improve. On the other hand, there is some question as to whether the system can be rigidly enforced.

Currently the Japanese Government is making an effort to control the flow of raw materials and other products into essential industries through the Economic Stabilization Board, a government agency established at a ministerial level.

The volume of foreign trade is still very low compared with prewar years. Uncertainties as to marketability of products, unsettled manufacturing conditions and domestic inflation-level prices have affected the export side. World scarcity of goods desired, lack of sufficient foreign-exchange credits and the considerable confusion existing in Japanese industry are some of the factors influencing the import outlook. Nevertheless, it is thought encouraging that export activity has progressed from the stage of exporting immediately available commodities, such as silk and accumulated stockpiles, to the point of negotiating arrangements with other nations for the purchase of Japanese manufactured goods.

This is according to a recent documented report from the Army's area petroleum officer in Tokyo which explains that it is a fundamental policy of General MacArthur, Allied supreme commander, to abolish the so-called Japanese control companies which completely dominated the wartime economic structure of that country. There can be no return of free enterprise, it is explained, while such privileged and exclusive organizations continue to operate. However, complete economic decontrol under existing conditions would be an impracticability, according to this report.

As an interim and short-term measure, the supreme commander has directed the Japanese Government to assume responsibility through government corporations for the distribution of essential materials which are in short supply. Petroleum, coal, and fertilizers are among the first commodities to be dealt with in this manner.

Activities of Petroleum Distribution Control Co. (P.D.C.C.), (The Oil and Gas Journal, July 6 and 13, 1946), are now carried on by the Petroleum Distribution Co. (P.D.C.), which continues, in practice, to be the sole distributor of petroleum products under the Minister of Commerce and Industry.

However, with the new government corporation law, passed only March 31 of this year by the Japanese Diet, establishing temporary state monopolies, a new company, Petroleum Public Co. (Kosha) probably will come into being shortly. A preliminary charter reportedly has been drawn up. Private U. S. oil companies which hope to carry on normal operations in Japan fear that this new government oil monopoly will only prolong the time when peacetime operations resume—although the supreme commander can nullify Kosha at his discretion.

Assisting MacArthur is the Petroleum Advisory Group. P.A.G. is comprised of civilian oil men on loan to MacArthur but acting solely in the interests of the occupying forces and not directly connected with their own company operations, although a greater amount of company correspondence is now allowed than has been the practice heretofore. Representatives on P.A.G. include men from California Texas Oil Co., Ltd., Asiatic Petroleum Corp., Standard-Vacuum Oil Co., and Tide Water Associated Oil Co.

Pending the effective establishment of a petroleum Kosha the P.D.C. will continue to be the sole distributor of petroleum products in Japan. Thereafter, liquidators will be appointed for P.D.C. and liquidation will be

TABLE 1—ESTIMATED JAPANESE PETROLEUM REQUIREMENTS AND SUPPLY FOR FISCAL YEAR JULY 1, 1947, TO JUNE 30, 1948*

Estimated requirements:	Gasoline	Kerosene	Gas oil	Diesel oil	Fuel oil	Lube oil	Grease	Total	(Barrels)
Consumption, July-Sept. 1947	72,002	14,238	59,898	162,870	43,500	31,523	2,318	386,349	
Consumption, Oct.-Dec. 1947	77,918	17,611	68,073	213,148	43,500	34,265	2,509	457,024	
Consumption, Jan.-Mar. 1948	84,646	17,876	56,988	179,937	43,500	36,477	2,650	422,074	
Consumption, Apr.-June 1948	91,556	18,333	70,219	190,594	43,500	38,034	2,740	454,976	
Consumption, fiscal year	326,122	68,058	255,178	746,549	174,000	140,299	10,217	1,720,423	(10,819,740)
Working stocks on hand, June 30, 1948	33,878	6,942	24,822	73,451	20,000	35,701	1,783	196,577	(1,236,273)
Total requirements	360,000	75,000	280,000	820,000	194,000	176,000	12,000	1,917,000	(12,056,013)
Estimated supply:									
Stocks on hand July 1, 1947	29,566	5,325	19,422	74,392	.....	35,290	787	164,782	(1,036,314)
Products, indigenous crudes	36,000	25,000	12,000	72,000	3,000	48,000	4,000	200,000	(1,257,800)
Products, other indigenous sources	.....	.....	.....	.....	.....	210	.....	.....	(1,321)
Imports (1948 fiscal year)	294,434	44,675	248,578	673,608	191,000	92,500	7,213	1,552,008	(9,760,578)
Total supplies	360,000	75,000	280,000	820,000	194,000	176,000	12,000	1,917,000	(12,056,013)

*Figures in kiloliters except as indicated. One kiloliter equals 6.289 bbl. Not included are wax, asphalt, and sundry products.

carried out within the lifetime of Kosha. However, the operational functions of Kosha have not yet been finalized. The Japanese, so accustomed to their control companies, may find it difficult to introduce new economic practices on such short notice, although petroleum Kosha is only another government monopoly.

Even if the Japanese try to conform to the broad principles of the Kosha, modifications may have to be introduced, the report points out, and concessions made to the bureaucrats and the people as a whole. It must also be remembered that the functions and responsibilities of the Economic Stabilization Board will be great, and that this organization has as yet hardly developed to a stage where it can be expected to implement rationing control effectively.

At present, a rather complete line of petroleum products are produced from the processing of indigenous crudes, although most have a low standard of quality. Several grades of each class of products are produced and distributed, but no brand names are used in marketing. Some of the P.D.C. equipment and packages show the old Fuji-Sahura marking which is the former basic brand for gasolines. However, this mark is now used only as the company or house-flag emblem.

Products imported by Boeki-Cho (the sole Japanese import-export agency) from War Department supplies also are not sold by brand names, rather merely by product. Moreover there is no distinction made between imported and domestic petroleum products. Currently, range oil is being supplied for gasoline, 7-0-2 diesel oil for gas oil, and Navy special fuel oil for diesel and fuel-oil requirements.

Approximately 132,000 bbl. of storage at the Tide Water-Mitsubishi refinery at Kawasaki have been taken over by the U. S. Army and lightened T-2 tankers are being accommodated at the refinery berth. Army storage at Azuma Island, Yokosuka, has been abandoned in view of the adequacy of tankage brought into use in the Matsukata-Ogura plants.

The Petroleum Distribution Co. (P.D.C.) continues to use the Tsurumi area tankage and to receive imported oil in lightened T-2 tankers. Cargoes originally were confined to gasoline but were soon extended to include kerosene. Later, direct importation of diesel oil at Tsurumi became standard practice. In the future gas oil is to be handled similarly.

Available tankage to P.D.C., in the Tsurumi area includes 275,000 bbl. for white oil and 362,000 bbl. for black oil.

A company known as the Japanese Oil Storage Co. (Josco) and comprised of the following five companies, distributes petroleum products for military use throughout Japan, as well as taking care of offshore shipments to the surrounding areas: Standard-Vacuum Oil Co., Union Oil Co. of California, California Texas Oil Co., Ltd., Asiatic Petroleum Corp., and Tide Water Associated Oil Co. This five-company set-up handles commercial transactions on a cost-plus basis, but only for the military. Josco's organization was based on a similar oil-company pattern which first operated in the Philippines.

When Josco's operations are no longer needed from a military standpoint, when sufficient private storage has been constructed and possibly bought by the military, and when Japan's over-all economy is greatly improved, it is assumed that these five companies will be allowed to resume peacetime competitive operations in Japan and that Josco will be dissolved.

As for when commercial transactions will be resumed between the Japanese and foreign nationals, it still seems to be anybody's guess. However, with MacArthur's recent appeal for an early peace with Japan, it may be sooner than originally surmised.

Early this year the U. S. State and Treasury departments announced the issuance of Public Circular No. 34 relaxing certain wartime restrictions against business and commercial communication with Japan and Germany. However, all such communications are subject to censorship.

Although inquiries concerning possible trade relationships, such as the nature, quantity, and availability of materials are authorized, attention has been directed to the fact that any trade transactions arising out of such communications must be effected through U. S. governmental agencies. Private commercial transactions will be authorized when arrangements for resumption of private trade have been made.

Meanwhile, only those companies rendering a service to the Army of Occupation are permitted to operate in Japan, and then under specific conditions laid down by MacArthur.

Foreign guests at the April 16 meeting of the Los Angeles chapter of Nomads included, standing, Paul Shighes, Colombian Petroleum Co., Cueta, Colombia; Henri C. Piek, production foreman for Standard Vacuum Oil Co., Netherlands East Indies; Paul Molidor, Tropical Oil Co., Colombia; and B. C. Haney, driller, Socony-Vacuum Oil Co., Colombia. Seated are T. D. Foster, drilling supervisor, Standard Vacuum Oil Co., Dutch East Indies; T. O. Oakes, driller, Iraq Petroleum Co., Iraq; and M. W. Zaikowsky, Texas Petroleum Co., Venezuela

New Colombian Petroleum Minister Appointed

Francisco de P. Vargas Velez has been appointed Colombia's petroleum minister. A lawyer, Vargas has been a senator and governor of the Department of Bolivar. Last March he was reelected senator.

Dr. Felex Mendoza, head of Colombia's National Petroleum Council states the council has pointed out to the government that Colombia's proved oil reserves are dwindling, and that widespread and intense exploratory activity is needed. The council has recommended construction of refineries in Cartagena, Buenaventura, Point Salgar, Bogota, and Medellin.

WASHINGTON WATCHING

BY HENRY D. RALPH

NPC's Future

WASHINGTON.—Last week's meeting of the National Petroleum Council may have been its final meeting.

If Congress finally determines that there shall be no more Oil and Gas Division in the Interior Department there will be little reason for the NPC to continue. Theoretically the council is advisory to the Secretary of the Interior on matters affecting all branches of the federal Government, so legally it could continue.

But as a practical matter it is necessary to have at least a small staff in the secretary's office to handle NPC matters, prepare for meetings, and keep informed on oil and gas developments. The chances are NPC would soon disintegrate if it met only with the secretary or an assistant secretary because these officials could not have the intimate knowledge of the industry that ODG staff has. Members would soon feel they were wasting their time coming to Washington.

However, there are no present plans for liquidating NPC. There is a possibility that Congress may ultimately vote sufficient funds to retain a skeleton OGD, and in any event Director Max Ball and three or four others may stay on for a while after the end of the fiscal year, June 30. This would permit at least one more meeting of the council. There are a number of important committee reports to be made, and while they could be approved by mail it is probable the membership will want to discuss them at a formal session.

Basic OGD Legislation

THE suggestion that new legislation be enacted to give the Oil and Gas Division legal standing and thus justify appropriations is not likely to be followed.

The appropriations committee rather invited this in its report, saying the appropriation for OGD was eliminated "until Congress adopts basic legislation for the work." While it is true that the rules of Congress permit a point of order to be made against any item in an appropriation bill not authorized by substantive law, the Interior Department takes the view that the OGD is a section of the secretary's office rather than a bureau of the department. Under this view no legislation is required since OGD is not undertaking any new functions, the secretary of the interior is charged with responsibilities over many oil and gas matters, and is empowered to have a group of oil and gas experts on his immediate staff.

For some time Director Max Ball has been considering asking for substantive legislation for OGD, but not for the purpose of obtaining appropriations. His idea was to write into law the things the division should not do and thus quiet fears in the industry that it might assume regulatory powers and fears in other government agencies that it might encroach on their jurisdictions.

Curious Economy

IN eliminating the $245,000 requested to operate the Oil and Gas Division for 1 year, the House appropriations committee has lost to the Government the services of oil-industry experts worth many times that sum.

With no OGD there will be no National Petroleum Council, and NPC already has done far more for the Government than OGD has done for the oil industry. The council itself costs the taxpayers nothing at all. The members serve without compensation, not even the per diem usually paid to government consultants, and come to Washington at their own expense. They have assessed themselves for an annual budget of $50,000 to maintain an office and finance committee expenses. The salaries of the 70 or 80 top-drawer industry executives for the time spent on NPC affairs probably amounts to considerably more than the cost of OGD. In addition, around 100 industry experts have been serving on council subcommittees and technical groups.

In this way the Government has had the benefit of information and advice on oil and gas matters which would cost the taxpayers tremendous sums if obtained entirely by government personnel. The value of this was just beginning to be appreciated by various government agencies.

The misconception of the appropriations committee regarding the OGD is evident in its report, which states that the purpose of the division is to serve the industry with statistics and studies which the industry cannot get itself without violating the antitrust laws. There is not one word in the committee hearings to justify such a statement. Actually OGD has rendered no service to the industry other than to make a start toward coordinating the policies and programs of various federal agencies and thus make it easier for the industry to deal with the Government. To date the activities of OGD and NPC have been for the Government, with only indirect and byproduct benefits to the industry.

And the committee's crack about the antitrust laws gives the false impression that the industry is getting OGD to help it do something illegal.

A Serious Supply Problem

AN alarming picture of an impending fuel shortage could be painted from the data presented to the National Petroleum Council last week except for the fact that all present took the view that the situation, while requiring serious attention, does not forbode anything like disaster.

The difficulty, it was agreed, is that consumption has increased, to the surprise of all prognosticators, beyond the peak of wartime demand, while the industry has not been able to expand its facilities in proportion because of shortages of materials. In spite of this, most NPC members felt that the worst that will happen is temporary shortages in some areas during the next heating season, hand-to-mouth distribution, and inability of some dealers to accept any new fuel oil customers.

Procurement officers for the Army, Navy, Maritime Commission, and Bureau of Federal Supply (which purchases for the civilian government departments) were the gloomiest because some of their purchase offers have found no bids in recent weeks. But industry men assured them that essential government requirements will be taken care of even though this may put a further strain on commercial supplies.

Here are some of the figures quoted to the council to show the problem: In 1945, the peak war year, consumption of all petroleum products was 5,358,000 bbl. per day; in 1946 it was 5,321,000, and for 1947 it is estimated at 5,650,000. Distillate fuel demand was 718,000 bbl. daily in 1945, 746,000 bbl. daily in 1946, and is estimated at 849,000 bbl. daily in 1947. Motor gasoline consumption was 2,148,000 bbl. daily in 1945, 2,138,000 bbl. daily in 1946, and is estimated at 2,252,000 bbl. daily in 1947. There were 525,000 new industrial and domestic fuel-oil burners installed during 1946, including 50,000 replacements, and it was estimated that there will be 3,413,000 in use by the end of this year.

Tank-Car Shortage to Continue, NPC Report Indicates

WASHINGTON.—A request that the oil industry be represented on the steel-allocation conference of the Office of Defense Transportation in order to secure the construction of more railroad tank cars was authorized by the National Petroleum Council last week on recommendation of its rail-transportation committee.

This conference is composed of representatives of railroads, steel companies, and car manufacturers, and the committee said that steel made available for tank cars this year is wholly insufficient even to complete the construction of liquefied petroleum gas, chlorine, and sulfuric acid cars now on order.

Tank-car loadings of all products in recent months have been 13 to 20 per cent above a year ago, and at present there is a shortage of Class 103 tank cars for petroleum use of 7,500 cars, the committee reported. During the last 2 years the number of tank cars of this class in service has decreased by 6,000 cars, none have been constructed since 1942, none are under construction now, and no steel has been made available for this purpose.

The situation with respect to L.P.G. cars is critical, the report declared. There are 2,908 Class 105 cars now in service, including 438 government-owned cars, but requirements for the coming fall and winter are for 5,279 cars, making a shortage of 2,371 cars, all of which have been ordered. Only about 900 of these will be built by the end of this year, so the L.P.G. industry will still be short at least 1,471 cars.

In addition to an allocation of steel for new cars, the committee recommended that at least 30,000 tons of steel be made available to tank-car owners for repairs, the committee said. It noted that many tank cars are in bad order and should be retired from service, and that the tank-car brake requirements of the Interstate Commerce Commission will require that many cars be taken out of service on January 1, 1949.

Tank Truck Outlook Better

The committee on petroleum truck transportation reported a more optimistic situation and made no specific recommendations. Including only trucks and trailers of 2,000 gal. and greater capacity, the committee estimated that for-hire petroleum carriers had increased their capacity approximately 16 per cent since 1944, and that private carriers (oil companies) had increased their capacity approximately 31 per cent. This indicates that the total tank truck capacity as of January 1, 1947, was 83,019,710 gal., an increase of 22.5 per cent over 1944.

Estimates of further changes in the fleet capacity show that private carriers expect a 67 per cent increase over January 1, 1945, during the next 3 years, and that for-hire petroleum carriers anticipate an increase of 26.6 per cent for the same period.

Changes in Industry Statistics Asked

WASHINGTON.—Petroleum statistics now being compiled by the Government, trade associations, and industry publications constitute in the aggregate an invaluable basis for industry operations and for governmental and public analysis, it was reported by the statistical advisory committee to the National Petroleum Council.

The committee made a number of recommendations for improvement but concluded that additional information required for fuller coverage is rather limited and specialized and would be useful mainly for security studies by the Army and Navy.

The only new statistics which the committee recommended be collected are information on production and consumption trends of the industry outside the United States. It said these should be collected monthly by some government agency, such as the Bureau of Mines, to show, by countries and areas, production of crude oil and allied hydrocarbons, refinery runs, output of the four major products, and stocks, imports and exports of crude and major products. The committee also recommended that the Government report annually the rated throughput and cracking capacity of foreign refineries, but that the Government utilize data on foreign well completions and related information compiled by technical and trade journals.

While extensive data are available on the production of petroleum products, the committee reported, knowledge of the various uses to which these products are put is deficient. It recommended that the Oil and Gas Division take steps to fill this lack by encouraging agencies covering parts of this field to enlarge their reporting, by correlating and coordinating the data supplied by others, by filling in, or encouraging others to fill in, existing gaps in statistical data through the techniques of sampling, and by taking such additional steps as may be necessary to assure an annual survey of major products use.

P. I. E. A. Conference Will Open in Houston May 6

The nineteenth annual conference of the Petroleum Industry Electrical Association, held jointly with the Petroleum Electric Supply Association, will open May 6 in the Rice Hotel, Houston.

Opening day will be devoted to registration, special committee meetings and a meeting of the board of directors. Opening addresses and announcements are scheduled for Wednesday morning, May 7, with the first technical session slated for Wednesday afternoon.

Program of the technical sessions follows:

Wednesday, May 7

1:30 p.m.—Open meeting. "Two-Way Radio for Petroleum Industry," R. J. White, Philco Radio Corp., Kellogg Switchboard & Supply Co., Chicago; "The XY Switch," M. A. Clay, Stromberg-Carlson Co., Kansas City, Kans.; "Petroleum Industry Radio," F. W. Littell, Shell Pipe Line Corp., Houston, and chairman, P.I.E.A. radio committee.

Thursday, May 8

9 a.m.—Open meeting. "The Magic of Electronics," Gordon Volkenant, associate director of research, Minneapolis-Honeywell Regulator Co., Minneapolis; "Telephone Interference Factor of Industrial Machines," G. L. Oscarson, chief application engineer, Electric Machinery Manufacturing Co., Minneapolis; "New Materials and Their Uses in Design of New Equipment," F. R. Benedict, industry engineering manager, Westinghouse Electric Corp., East Pittsburgh, Pa.

1:30 p.m.—Open meeting. "Prospective Use of Electrical-Driven Centrifugal Blowers for Gas-Pipe-Line Transmission," W. H. Stueve, Oklahoma Gas & Electric Co., Oklahoma City; "Electric Power Requirements for Refinery's New Chemical Processes," Hugh M. Stewart, chief electrical engineer, Humble Oil & Refining Co., Baytown, Tex.

U.S. Gasoline-Tax Receipts Gain 11 Per Cent in March

Collections from the federal tax on gasoline during March totaled $27,578,547, a gain of more than 11 per cent over March 1946, according to the Bureau of Internal Revenue.

A slight drop was shown in collections from the federal tax on lubricating oil which declined from $4,863,612 in March 1946 to $4,756,137 in March this year. Collections from the tax on transportation of oil by pipe line totaled $1,071,890 against $1,190,902 in March 1946.

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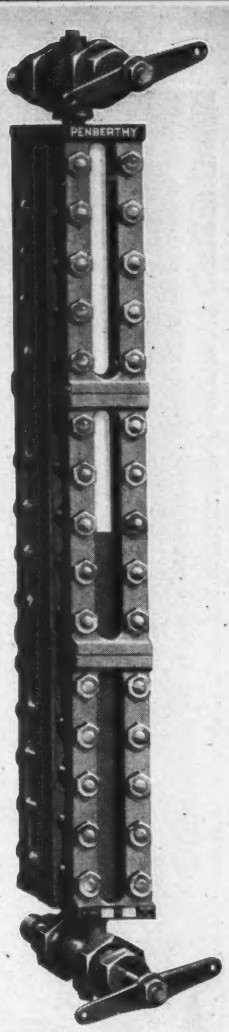

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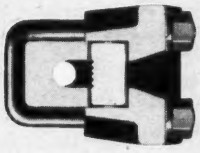

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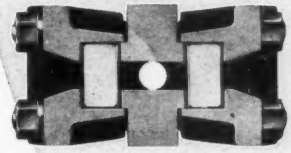
Transparent
DROP FORGED STEEL LIQUID LEVEL GAGES

Used to observe color and density of liquids under high pressures, and/or temperatures. Construction is exceptionally rugged . . . similar to Reflex types.



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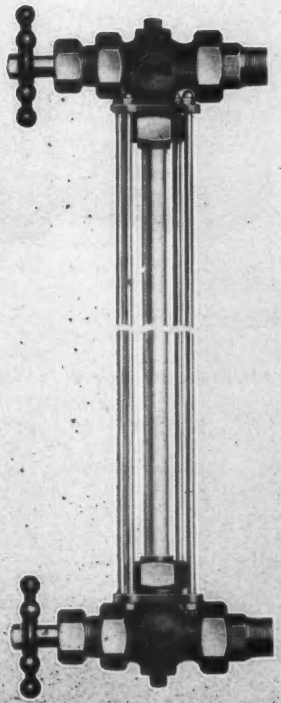

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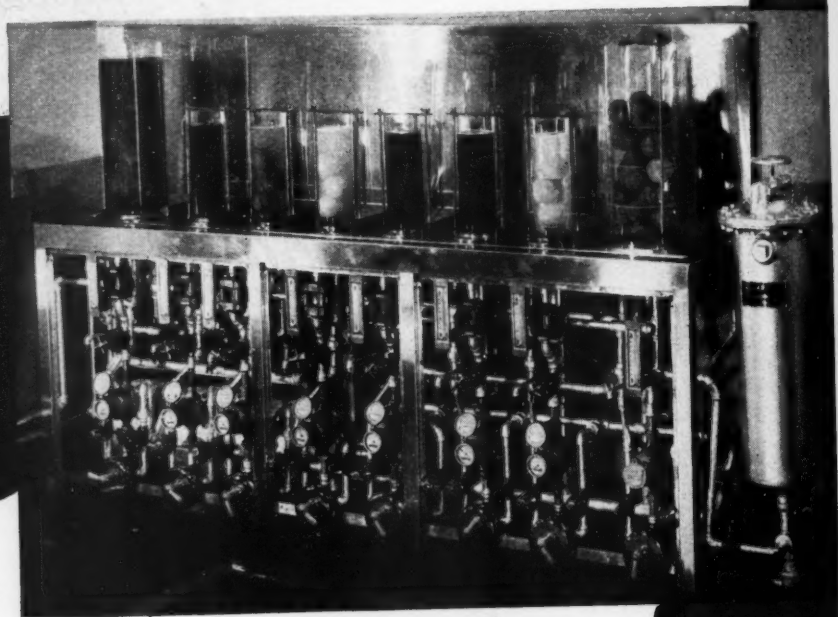
Check your plant maintenance and repair records with this example of Nalco water treatment efficiency in mind. If you have scale, corrosion or slime and algae problems, *now* is the time to get a Nalco Survey and recommendations for the beginning of permanently effective water treatment in your plant.



At right is shown one of the pieces of testing equipment in the Nalco Laboratories that help produce the permanent answers to water treatment problems of Nalco System users. This apparatus checks the solubility and dosage rates of Nalco Chemical Balls in Nalco Ball Test Feeders.

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Letters Show Moffett Suggested Expropriation to Arabian King

by Warren W. Burns

JAMES A. MOFFETT, who recently charged before a Senate committee that the Navy was overcharged on its wartime petroleum-products purchases from Arabian American Oil Co., proposed last year that the Saudi Arabian Government expropriate Arabian American's properties and turn over a controlling interest to Moffett and his associates, W. S. S. Rodgers, chairman of the board of The Texas Co., told Texaco stockholders at their annual meeting in New York.

Rodgers told the stockholders this constituted Moffett's "real motives" in making "false charges" against the company. Ownership of Arabian American is shared by The Texas Co. and Standard Oil Co. of California, and negotiations were begun late last year to expand ownership to include Standard Oil Co. (N.J.) and Socony-Vacuum Oil Co., Inc.

In copies of letters, released by Rodgers from Moffett to His Excellency Sheikh Asad Al Faquih, minister of Saudi Arabia to the United States, dated February 18 and 26, 1946, it was shown that Moffett suggested to Saudi Arabia's King Ibn Saud that he expropriate the Arabian American Oil Co.'s concessions and turn over controlling share to Moffett and his associates. Moffett also suggested that the king convey to the Sheik of Bahrein Moffett's desires to make a similar proposition in respect to Bahrein's oil concessions and properties. Rodgers explained that the Saudi Arabian minister in Washington had rejected both proposals.

Moffett's Proposals

Moffett's proposals, as indicated in his February 18 letter, were:

"1. Instead of taking payment on the basis of 22 cents per barrel that you take the oil on this basis: Within 1 year I will agree to purchase the oil from you on the basis of 44 cents per barrel with a minimum of 20,000 bbl. per day and a maximum of 50,000 per day.

"2. I will agree to pay in addition 10 cents per barrel for the oil delivered aboard ship; also to pay to you an export tax of 6 cents per barrel, or a total of 60 cents per barrel.

"3. You will arrange for delivery of oil to me, through the existing pipe lines of the Standard Oil Co. (meaning Standard Oil Co. of California) and 10 cents should cover the cost and give them a profit.

"In conclusion it would be my earnest desire to pay you an export tax of 20 cents per barrel instead of 6 cents. This would be dependent on the competitive attitude of the Britsh-owned oil companies, but it is my firm belief that this could be accomplished.

"For further consideration you have under international law the right of condemnation or exappropriation of the oil properties on the basis of their book value. As a rough estimate I assume at the present time a book value of $60,000,000. You might wish to pay them a good will item of 10 or 15 million dollars, but you are not obliged to do so.

"Assuming it would take $75,000,000, it would be my idea to raise one hundred to two hundred million dollars, you to have a 49 per cent interest in the company.

"Under this plan it would be a joint operation, the royalty payments would cease or be very materially reduced, the export tax would continue.

"It would be easy to expand the production and operation to 150,000 to 200,000 bbl. per day and I figure that a normal operation would earn between 75 cents to $1 per barrel which on the basis of 100,000 bbl. per day would equal $36,000,000 per annum; on 200,000 bbl. per day, $72,000,000, or a profit to you of from $18,000,000 to $36,000,000 per annum; in addition you would receive the export tax."

Additional details of the projected negotiations whereby Arabian American's ownership will be expanded also were revealed by Rodgers. He said:

"Under the contracts with Jersey Standard and Socony-Vacuum, Arabian American borrowed from banks the sum of $102,000,000 at 2 per cent interest for a period of 10 years, the repayment thereof being guaranteed 75 per cent by Jersey Standard and 25 per cent by Socony-Vacuum.

"If Jersey Standard and Socony-Vacuum receive an unfavorable decision within 4 years, Arabian American will repay this loan of $102,000,000, beginning payments in 1953 and completely liquidating the loan in 1957. If within the 4-year period Jersey Standard and Socony-Vacuum settle or win this lawsuit, they will then be obliged to purchase 30 per cent and 10 per cent respectively of Arabian American stock and pay therefor the sum of $102,000,000. Arabian American will then use this sum to pay off the bank loans. The interest on these loans in the latter event will be paid by the purchasers."

In connection with Moffett's charges that the U. S. Navy had been overcharged by Arabian American, Rodgers said that Arabian American (of which he is vice chairman) has employed Charles Evans Hughes, Jr., "to assist in presenting the full facts."

Commenting on Rodgers' statements and the letters, Moffett said he was "amazed" at the report and statement issued by Rodgers. "Mr. Rodgers . . . was unable to do more than state that my charges made under oath before the Senate war-investigating committee were 'absolutely false,'" Moffett said. Referring to what he called his "personal business approach to King Ibn Saud," Moffett said it is "obvious that this is injected for the sole purpose of beclouding the question. . . . " Moffett did not identify his associates mentioned in his letters.

United Proposes Service For Southeastern Area

WASHINGTON.—United Gas Corp., Shreveport, has filed an application with the Federal Power Commission requesting authority for the construction and operation of a natural-gas pipe-line system from near Hattiesburg, Miss., through Alabama, Georgia, and northern Florida and into southeastern South Carolina.

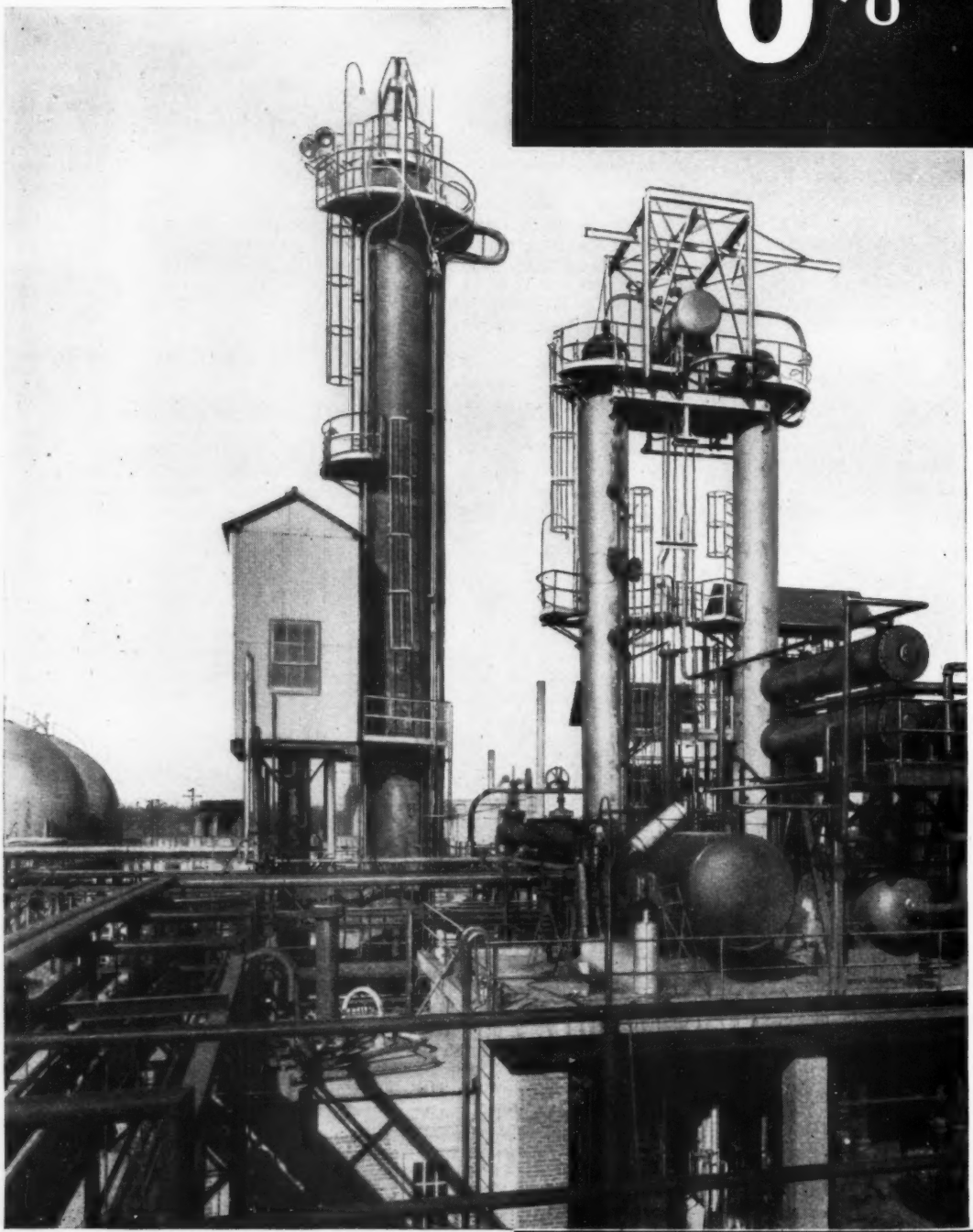
Over-all capital cost of the project has been estimated at $57,126,000. The builder and operator would be one of United's subsidiaries, or a subsidiary to be organized.

The service planned is sale of natural gas at city gates for resale in the various cities, towns, communities and rural areas along the route and direct gas sales to main-line industrial customers. There is at present no natural gas service in the area proposed to be served.

United Gas proposes that the subsidiary construct and operate approximately 1,530 miles of pipe line and compressor stations with an aggregate of 9,000 installed horsepower. Gas supplies would be purchased from United Gas Pipe Line Co., a wholly owned subsidiary of United Gas Corp., and deliveries would be made at a connection near Hattiesburg. United Gas stated that United Gas Pipe Line would enter into long-term contracts to provide gas for the new project and that it is presently connected to 124 gas fields in Louisiana, Mississippi, and Texas which have remaining reserves of 12,800,000,000 M.c.f.

PRODUCTION UP

6%



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This type of service is just one of the many ways UOP engineers are serving the petroleum industry. UOP processes and UOP engineering service are enabling many independent refiners to meet today's production and marketing requirements, fully utilize their equipment and keep operations at a profitable level. We shall be glad to discuss your refining problems with you.

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PERSONALS

L. S. Wescoat Elected Pure Oil President

L. S. WESCOAT, newly elected president of Pure Oil Co., had completed nearly 15 years of service as a business executive before joining Pure 22 years ago.

Born in Bridgeton, N. J., and educated there and in Philadelphia, Wescoat spent the first 10 years of his business life in administration and expansion activities of enterprises controlled by a Philadelphia banking group.

He served in World War I and upon his return joined Fisher Body Corp. in Detroit. In 1922 he became vice president and general manager of Southwestern Gas & Electric Co., in Shreveport, which owned public-utility properties and produced oil and natural gas.

Wescoat joined Pure in 1925 as general sales manager. In 1927 he was elected vice president and in 1932 was given the added title of secretary. He was named to the board of directors in 1936.

Now president of the Pure organization, Wescoat also is treasurer and a director of the American Petroleum Institute and chairman of the Institute's committee on highways and a director of the Automotive Safety Foundation and the National Highway Users Conference.

S. B. Bean, division superintendent at Colorado City, Colo., for Shell Pipe Line Corp., has been transferred to Hobbs, N. M. He has been succeeded by **E. M. Owen,** who was succeeded at McCamey, Tex., by **E. C. Reece,** formerly division superintendent at Hobbs. **E. E. Everett,** mechanical maintenance superintendent, has been transferred from Hobbs, N. M., to Wink, Tex.

H. C. Vanderpool, Dallas, former geologist with Seaboard Oil Corp., has been named chief geologist of Texas Pacific Coal & Oil Co., Fort Worth. He is a graduate of the University of Oklahoma, where he was an instructor for 2 years.

Edward Martin, U. S. Senator from Pennsylvania, was elected president of Dunn Mar Oil & Gas Co. at the company's annual meeting in Washington, Pa. **Edward H. Milliken,** Waynesburg, Pa., was named vice president, and **Stewart M. Vockel,** Pittsburgh, president of Waverly Oil Works Co., treasurer. **Richard Landis Vockel,** Pittsburgh; **Edward S. Martin,** Washington, Pa., and **Dr. A. J. Blair,** Waynesburg, were elected to fill vacancies on the board of directors.

J. J. Rasor, supervisor of light-oil processing at The Texas Co.'s Port Arthur, Tex., refinery, has been appointed assistant superintendent of the company's West Tulsa refinery, effective May 1. He succeeds **Roy C. Schorlemmer,** who was transferred to the Port Neches plant as superintendent.

Henry Andrew Campo, Atlantic Refining Co., Shawnee, Okla., has been named president of the Shawnee, Okla., Geological Society. **F. J. Smith,** Sinclair Prairie Oil Co., Seminole, was elected vice president, and **Miss Marcelle Mousley,** Atlantic Refining Co., Shawnee, secretary-treasurer.

George F. Cance, chief of S. N. Marep's engineering department in Paris, has replaced **Roger Buttin** at the company's New York offices. Buttin will shortly start on an extended trip through Texas and California, returning to France in late summer. S. N. Marep (Societe Nationale de Material pour la Recherche et l'Exploitation du Petrole) is a private French purchasing agency. In his new position, Cance will be technical assistant to **Marcel Schwob,** manager. **Jean Bertaux,** now in charge of the company's traffic department in New York, will return to France this summer. His successor will be **Maurice J. Binet,** from the Paris office, who will be in charge of the commercial and traffic departments. **Pierre E. Abadie,** who has been in charge of S. N. Marep's Washington office since May 1946, plans to return to France in May.

Donald E. Payne, Standard Oil Co. (Ind.), has been promoted to assistant general patent attorney, and **Vanderveer Voorhees,** senior patent attorney, for the company. Payne, who received a chemical-engineering degree from the University of Idaho in 1922, was admitted to the Illinois Bar in 1928 and joined Indiana Standard's development and patent department a year later. Voorhees joined the company's research staff after receiving a Ph.D. in organic chemistry following work at the University of Wisconsin and the University of Illinois.

Henry M. Dawes was named chairman of the newly formed executive committee of Pure Oil Co. at a meeting of the company's board of directors last week in Chicago. **Rawleigh Warner** was elected chairman of the board and **L. S. Wescoat,** president of the company. Members of the new executive committee are **R. W. McIlvain,** vice chairman, **Beman G. Dawes,** Warner, Wescoat, and **C. B. Watson.** Changes in organization and personnel were necessitated by the increased size and complexity of the company's operations, a company announcement said. Other officers elected by the board were: **Comer Plummer,** vice president for production; **J. P. Langfitt,** vice president for refining; **D. D. Irwin,** vice president of transportation and supply; **R. H. McElroy,** vice president for marketing; **C. W. Snider,** assistant vice president for marketing; **Curtis Dawes,** assistant vice president for southern marketing operations; **G. W. Sanders,** assistant vice president for wholesale marketing; **R. W. McIlvain, Jr.,** assistant vice president for production; **W. V. Keeley,** assistant vice president for insurance and taxes; **J. W. Rees,** assistant vice president for personnel; **W. J. Arnold,** assistant vice president for accounting; **R. L. Milligan,** treasurer; **C. H. Jay,** secretary; **J. H. Botkin,** comptroller; and **Harry L. Wylie,** assistant treasurer.

R. WARNER

C. V. Millikan, petroleum engineer for Amerada Petroleum Corp., Tulsa, addressed a recent joint luncheon meeting of the Fort Worth Geological Society and the Petroleum Engineers Club of Fort Worth. His subject was "Petroleum Engineering or Petroleum Geology?"

Edmond C. Breene, Jr., formerly of Oil City, Pa., has been promoted to field manager in Talara, Peru, for International Petroleum Co.

Dr. George S. Hume has been promoted to chief of the Bureau of Geology and Topography under **J. E. Glen,** Canadian minister of mines and resources. Hume, who in 1946 was awarded the Order of the British Empire, succeeds **F. C. C. Lynch,** recently retired.

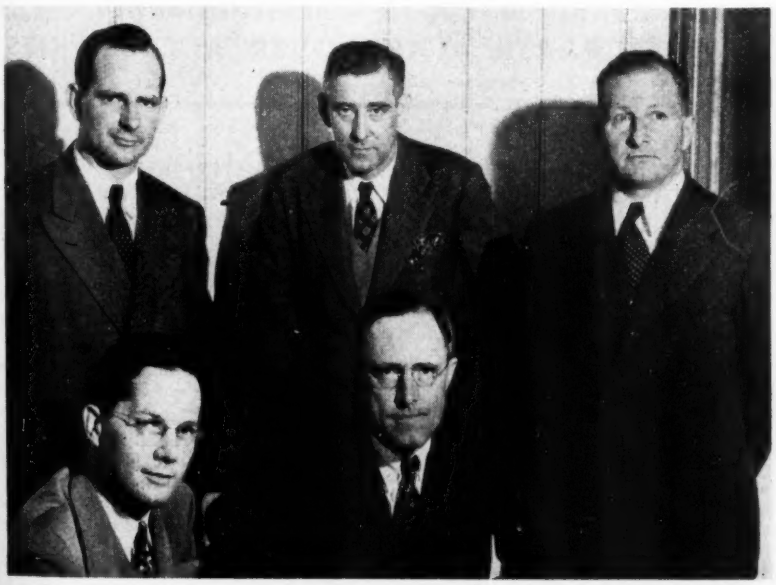
Hubert Guyod, Houston, well-logging consultant, was the guest speaker at a meeting of the Petroleum Engineering Club (American Institute of Mining and Metallurgical Engineers student affiliate) of Texas A. & M. College April 25.

W. C. Whaley, vice president of Barnsdall Oil Co. and general manager of its California operations, has been reelected president of Oil Producers Agency of California. Other officers, all reelected for a second term, are: **H. E. Woodworth,** Safe Oil Co., first vice president; **R. H. Garrison,** Hellman Estate, second vice president; **C. C. Spicer,** Republic Petroleum Co., third vice president; **C. A. Johnson,** Holly Development Co., fourth vice president; **Rush M. Blodget,** Blackfoot Petroleum Co., executive vice president; **W. A. Russell,** Seaboard Oil Co., secretary-treasurer; **Verne Harrell,** Bankline Oil Co., assistant secretary-treasurer; **Stark Fox,** recording secretary. Directors elected for the 3-year term ending April 1950 are: **A. E. Bell, Rush M. Blodget, L. A. Cranson, W. H. Geis, Richard A. Grant, R. E. Havenstrite, C. A. Johnson, DeWitt Knox, Cecil M. Rood, Lawrence Vander Leck, Dwight G. Vedder,** and **W. D. Waltman.**

Cecil C. Irby, production superintendent in Michigan for Sohio Petroleum Co., will be transferred to Russell, Kans., as superintendent in Kansas, succeeding **P. C. Musgrove,** effective May 1.

Fred M. Ziegler, long associated with the California company of Kern Oil Co., Ltd., London, has been appointed managing director of Kern's British West Indies subsidiary, Kern Trinidad Oilfields, Ltd. Ziegler's new duties will call for a division of time between Trinidad and California.

Charles S. Penfield has been appointed general drilling superintendent for Shell Oil Co., Inc., filling the vacancy left by the recent death of Walter Eliot. Penfield joined the company in 1915 as a pipe-line worker. He entered the drilling department the following year and became a foreman in 1926. Since then he has served as drilling superintendent in Los Angeles Basin and the San Joaquin division and spent 3 years in Canada.



New officers of the Mid-Continent section of the American Institute of Mining and Metallurgical Engineers will be installed at the section's annual roundup meeting late in June. Seated: R. C. Earlougher, president of Earlougher Engineering, retiring chairman, and P. P. Manion, Jr., conservation engineer, Stanolind Oil & Gas Co., new chairman. Standing: John P. Hammond, production engineer, Amerada Petroleum Corp., first vice chairman; J. J. Arps, chief engineer, British American Oil Producing Co., second vice chairman; and R. H. Gwinner, chief engineer, Sunray Oil Corp., secretary-treasurer. All are of Tulsa

Raymond L. Dillard, president, J. K. Hughes Oil Co., Mexia, Tex., was elected president of the East Texas Chamber of Commerce at its annual meeting in Henderson, Tex. **D. A. Hulcy,** president, Lone Star Gas Co., was named to the board of directors. Dillard is the youngest president in the organization's history.

SHIFTS—

R. H. Sanborn, chemist, Bell Oil & Refining Co., Santa Maria to Covina, Calif.; **C. T. Rankin,** geologist, Amerada Petroleum Corp., Taft, Calif., to Green River, Wyo.; **Virgil J. Glenn,** foreman, B & B Construction Co., Weatherford to Odessa, Tex.; **J. T. Payton,** engineer, The Texas Co., Humble to Conroe, Tex.; **John T. S. Ross,** geologist, Seismograph Service Corp., Crowell to Vernon, Tex.

A. K. Thorn, foreman, The Texas Co., Fort Stockton, Tex., to Jal, N. M.; **N. A. Tinker, Jr.,** engineer, Gulf Oil Corp., Wickett to Wichita Falls, Tex.; **J. A. Prickett,** engineer, Magnolia Petroleum Co., Dallas to Alice, Tex.; **A. Gensberg,** engineer, Gulf Oil Corp., Electra to Odessa, Tex.; **Rubin E. Kappler,** engineer, Humble Oil & Refining Co., Goose Creek to Baytown, Tex.

William L. Cain, engineer, Phillips Petroleum Co., Odessa, Tex., to Bartlesville, Okla.; **John H. Garner,** engineer, Republic Natural Gas Co., Refugio to Taft, Tex.; **Philip H. Lipstate, Jr.,** engineer, Penetron Service Co., Tyler, Tex., to Laramie, Wyo.; **Vassar E. Lewis,** engineer, Continental Oil Co., Wichita Falls to Borger, Tex.; **A. B. Wardlaw,** superintendent, The Texas Co., Erath to New Orleans; **C. L. Sparkman,** superintendent, Humble Oil & Refining Co., Leesville to Maringouin, La.; **Charlie Love,** superintendent, Spartan Drilling Co., Haynesville to Brookhaven, Miss.

Marion D. Olive, engineer, Barnsdall Oil Co., Cotton Valley to Jennings, La.; **I. J. Reed,** geologist, The California Co., Tallahassee, Fla., to New Orleans; **Paul H. Fox,** superintendent, Plantation Pipe Line Co., Winder to Hartwell, Ga.; **G. Murray Gillespie,** geologist, Olney to Flora, Ill.; **Fletcher F. Farrar,** engineer, The Texas Co., Salem to Sims, Ill.

Rowland D. Young, superintendent, Justrite Drilling Co., Mount Vernon, Ind., to Fayetteville, Ark.; **J. T. Gilliam,** foreman, Amerada Petroleum Corp., Yazoo City, Miss., to Cody, Wyo.; **J. R. Gilliland,** foreman, General Geophysical Co., Holyoke, Colo., to Grant, Neb.; **Paul R. Anduss,** foreman, Sunray Oil Corp., McPherson to Hutchinson, Kans.; **W. C. Sylvester,** engineer, Ohio Oil Co., McFadden to Powell, Wyo.; **Harry A. DuPont,** engineer, Phillips Petroleum Co., Oklahoma City to Kaw, Okla.

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INTERNATIONAL *Trucks*

Here are members of the oil industry's public-relations operating committee who will meet next in New York, May 7-8. Seated: Edwin W. Esmay, Standard Oil Co. (N. J.), New York; J. L. Dupree, Socony-Vacuum Oil Co., Inc., New York; C. R. Musgrave, Phillips Petroleum Co., Bartlesville, Okla.; Philip C. Humphrey, The Texas Co., New York; Richard Rollins, Atlantic Refining Co., Philadelphia; Keeton Arnett, Fred Eldean Organization, New York; John S. Cooke, American Petroleum Institute, New York, secretary; Franklyn Waltman, Sun Oil Co., Philadelphia, chairman; Fred Eldean, New York; Merle Thorpe, Cities Service Oil Co., New York; Douglas Campbell, Pure Oil Co., Chicago; H. L. Curtis, Shell Oil Co., Inc., New York; Robert E. Allen, A.P.I., New York; W. R. Huber, Gulf Oil Corp., Pittsburgh. Standing: North Bigbee, Texas Mid-Continent Oil and Gas Association, Dallas, vice chairman; Edgar A. Waite, Standard Oil Co. of California, San Francisco, vice chairman; Conger Reynolds, Standard Oil Co. (Indiana), Chicago, vice chairman; Ralph Champlin, Ethyl Corporation, New York, vice chairman. Members of the committee not present are: Haines Finnell, Union Oil Co. of California, Los Angeles; George H. Freyermuth, Standard Oil Co. (N. J.), New York; Don E. Gilman, Western Oil and Gas Association, Los Angeles; Robert T. Haslam, Standard Oil Co. (N. J.), New York; Clarel B. Mapes, Mid-Continent Oil and Gas Association, Tulsa; John Wieland, Standard Oil Co. (Ohio), Cleveland

Advertising Campaign to Carry Industry's Story to Public

WASHINGTON.—Approval of a national advertising campaign under American Petroleum Institute auspices as a part of the industry's public-relations program has been announced by the public-relations committee of the A.P.I.

John M. Lovejoy, chairman of the committee, stated that the program, which is on limited basis, will be supervised by the A.P.I. public-relations operating committee, which has been authorized to retain the firm of Sullivan, Stauffer, Colwell & Bayles, New York, to conduct the program.

The A.P.I. public-relations committee acted at its quarterly meeting here April 21. Lovejoy announced this committee had adopted a resolution commending the work of the operating committee and the Fred Eldean Organization. Franklyn Waltman, chairman of the operating committee, reported that of the 11 public-relations area committees being set up, 7 had completed their organization and that the other 4 would be ready to function within the next 2 weeks. These committees will direct the program in their respective areas, assisted by field representatives from the Eldean organization.

Launching of the newly approved advertising program will engage the operating committee's attention during the next 3 months and will mark the beginning of plans to carry the program to the country, he continued. National magazines will be used, commencing in August and continuing until December, for the institutional advertising to be sponsored by the Institute. The plan includes a tie-in merchandising campaign to encourage oil companies, associations, and other groups to sponsor related advertising in newspapers and on the radio at the local level.

DEATHS

W. C. Trout, 73, president of Lufkin Foundry & Machine Co., Lufkin, Tex., and a past president and director of the National Manufacturers Association, died April 24 in a Dallas hospital. A large producer of oilfield equipment since the middle 1920's, Trout for 3 years served as president of the Texas Manufacturers Association. He was a director of Southland Paper Mills, Inc., Texas Foundries, Ind., and had interests in other varied business concerns. Born in Canada, Trout moved to Milwaukee, Wis., with his family in 1884. He moved to Texas and bought an interest in the Lufkin company in 1905.

E. B. Wood, 46, sales engineer for Wyatt Metal & Boiler Works, Houston, died April 18. He has been associated with the company 12 years, prior to which he served with Parkersburg Rig & Reel Co. in South America.

Ralph Hayden Harris, 28, former University of Oklahoma football player and derrick man for Kerr-McGee Oil Industries, Inc., died April 24 in an oil-well fire near Vernal, Utah.

Myron Matson Edmonds, retired oil producer, died April 19 at his home in Bradford, Pa.

Frank Podvolecky, 60, Houston, mechanic for Noble Drilling Co. for 12 years, died recently in Eunice, N. M.

Samuel Henry Houston, 41, Brenham, Tex., geologist for Humble Oil & Refining Co. for the last 16 years, died April 19 in a Houston hospital.

Arthur W. Epley, Jr., 30, George West, Tex., party chief for Seismic Explorations, Inc., died April 22 in Corpus Christi.

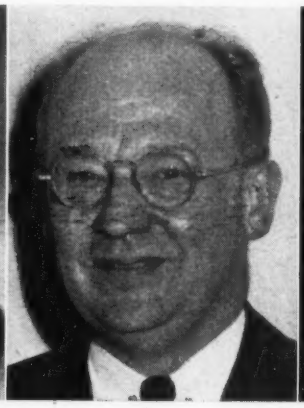
James C. Brannon, 50, Odessa, Tex., driller, died April 19 in Tatum, N. M. Brannon formerly resided in Corsicana, Tex.

W. H. Efaw, 52, Wichita, Kans., former drilling contractor, died April 21 in Wichita.

FEATURING— *Annual Spring Meeting, Natural Gas Department, American Gas Association*

R. H. HARGROVE
President, A.G.A.
Speaker at General Session

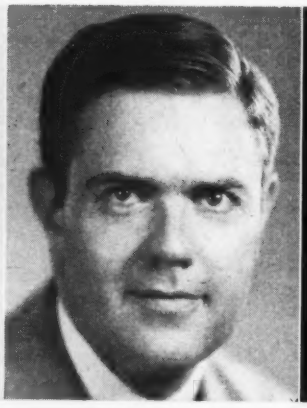
ROBERT W. HENDEE
Chairman, Natural Gas Department, A.G.A.



H. J. CARSON
Chairman, Transportation Committee

H. D. HANCOCK
Chairman, Technical and Research Committee

FRED W. PETERS
Chairman, Accounting Committee, Natural Gas Department



J. WILLIAM FERGUSON
U. S. Bureau of Mines, Speaker at General Session

E. O. THOMPSON
Texas Railroad Commissioner, Speaker at General Session

GEORGE R. BENZ
Speaker at open meeting of Transportation Committee

Natural Gas Industry Headed for New Records

CHICAGO.—All phases of the natural-gas business were discussed here April 30 and May 1 at the annual meeting of the Natural Gas Department of the American Gas Association. Reports revealed that the production, transportation, and distribution of natural gas are expanding rapidly with more projects under way or plánned for 1947 than during any previous year in the industry's history.

Some of the legal high points and thoughts of the industry on well-head price fixing were put forth by Glenn Clark, of Cities Service Gas Co., Oklahoma City (see article on page 71). Pipe-line flow equations were reported by J. William Ferguson of the U. S. Bureau of Mines. Amarillo; and Irving J. Peck, vice president and general manager, The Manufacturers Light and Heat Co., Pittsburgh, detailed the problems of the house-heating load that gas companies experience in various sections.

Conservation from a number of angles was the keynote at the second general session—research problems, flare gas, underground storage. What the A.G.A. has done in research and development progress was described by H. D. Hancock, president, Gas Advisers, Inc., New York City. What is being done to eliminate flare-gas wastage was told by Ernest O. Thompson, chairman, Railroad Commission of Texas. What the Interstate Oil Compact Commission views as conservation was given by Hiram W. Dow, chairman, Interstate Oil Compact Commission, Roswell, N. M. One way to conserve gas from venting and wastage and to conserve on operating machinery and effort during off-peak periods is to store gas by injecting it into underground reservoirs—later to be withdrawn as needed. An interesting symposium on this practice was presided over by L. T. Potter, assistant to president, Lone Star Gas Co., Dallas.

Gas-Turbine-Driven Centrifugal Compressors For Natural Gas Pipe Lines

by E. T. P. Neubauer*

MOST economical means of transporting large volumes of natural gas is through pipe lines of appropriate size and at relatively high pressures. If the pipe line extends over any great distance, the pressure drop along the line becomes an appreciable factor and means of compressing the gas back up to the higher pressure must be provided at regular intervals along the line. Compressors required for this work must be driven by some power-generating equipment which in turn must draw upon some source of energy for the development of the necessary power. The lowest-cost energy source for this service is the natural gas in the pipe line. It is, therefore, advisable to design the compressor equipment to take advantage of this low-cost energy except where other very special circumstances exist, such as the conversion of the Big Inch lines.

Up to the present time the major gas pipe-line compressor stations have been of the reciprocating type, using reciprocating gas engines for the motive power. This type of unit conforms to the basic requirement of natural-gas transportation through pipe lines. However, the reciprocating equipment, due to its engineering nature, must be operated at relatively low speeds; and due to size limitations, many cylinders are required to handle the total volume of a large pipe line. In consideration of the above problems, it has been found most economical to space the reciprocating compressor stations at intervals of approximately 100 miles, which under design conditions results in a required compression ratio of about 2 to 1 for the compressor stations.

By reducing the distance between compressor stations to about 50 miles a saving of over 30 per cent in adiabatic horsepower will result. A natural-gas pipe line with the compressor stations spaced at 50 miles or less, will call for equipment with lower maintenance and service requirements and occupying less floor space than now found in the reciprocating compressor applications. These requirements can best be met by the application of rotating machinery so that speeds can be considerably increased.

Comparison of Performance

Comparing the performance characteristics of the centrifugal compressor and the axial compressor (Fig. 1) will show that for pipe-line work, where some degree of capacity control is desired, the centrifugal compressor will best meet the requirements. The axial compressor has a much higher efficiency but its capacity control features are not desirable. Furthermore the axial machine for a 250,000,000-cu. ft.-per-day line would be small in size and require a very high rotative speed.

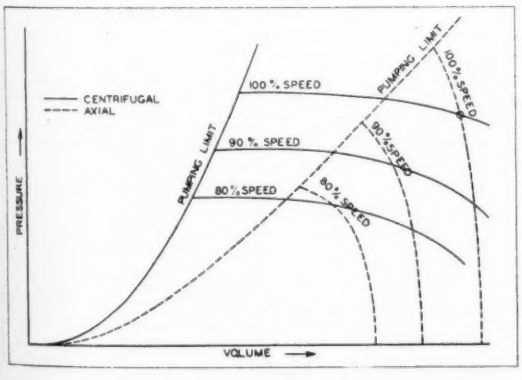
Centrifugal compressors are best adapted to handle comparatively large gas volumes, and moderate pressure ratios, thus one unit can handle the entire volume of a relatively large gas pipe line. For high-pressure ratios it is possible to operate them in series with intercoolers if and when needed. For economical transportation of natural gas through a pipe line it is possible to so space the pumping stations that the resultant pressure drop will permit the use of the centrifugal compressor.

It is not the numerical value of the pressure difference which determines the applicability of the centrifugal compressor. It is the compression ratio and the characteristics of the gas being compressed, which will determine its use. For example, a two-stage machine operating at a moderate tip speed is capable of producing a compression ratio of about 1.33 to 1. For an 815-psia. discharge pressure, this would result in a pressure rise of 200 psi. and thus a suction pressure of 615 psia. These conditions would permit compressor station spacings of about 55 to 65 miles.

Having only rotating parts, the centrifugal compressor is readily adapted to automatic operation, resulting in low maintenance and service costs. For handling rather large volumes of gas, such as 250,000,000 cu. ft. per day and at over 600 psi. pressure, the physical dimensions of this type compressor are rather small, and the relatively small unit is ca-

*Engineer, blower and condenser department, Allis-Chalmers Mfg. Co., Milwaukee.

A paper presented at the annual spring meeting of the Natural Gas Department, American Gas Association, Chicago, April 30-May 1.



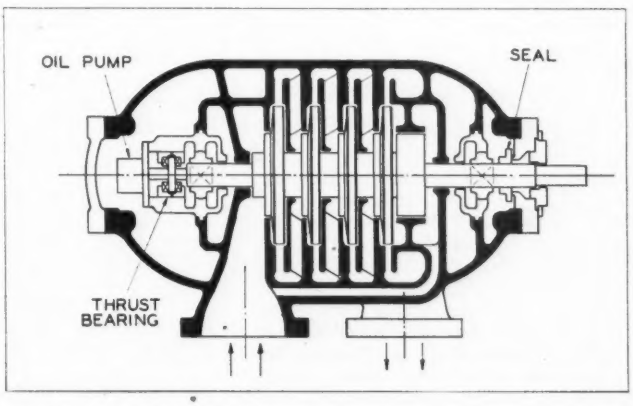


Fig. 1—(Left) Characteristics of centrifugal and axial compressors. Fig. 2—(Right) Cross-section of enclosed multistage centrifugal compressor with single full-pressure shaft seal

pable of absorbing a very high power rating. The design of the rotating elements is not seriously affected by the higher pressures and power ratings. The major changes demanded by these conditions are the casing and seal design.

Within certain limits the centrifugal compressors are self-regulating, that is, the capacity of a machine driven at constant speed may vary according to the demand on the system as illustrated in Fig. 1. This self-regulating characteristic exists down to about 50 per cent of design capacity and if the variation in demand exceeds this limit, other means are available to regulate the flow automatically, such as speed control or pre-rotation vanes.

What Has Retarded Use?

With the above picture so highly favorable for the centrifugal compressor in the gas-pipe-line application, one is faced with the obvious question: "Why are they not extensively used in this field?" The major answer to this question is that technical progress up to the present time did not provide an economical prime mover for the centrifugal compressor, and that the seal problem had not been solved for the high pressures involved.

A centrifugal-compressor pipe-line application operating at relatively high inlet and discharge pressures requires a driving unit capable of producing a large horsepower rating at relatively high rotative speeds. These requirements limit the driving unit to electric motor, steam turbine, and gas turbine.

The electric-motor application can be used as a direct-drive unit (3,600 r.p.m.) in which the compressor would be required to have four to five stages (see Fig. 2). This drive would also permit the use of the "sealed in" unit, thus greatly reducing the problems to be encountered in the seal design. With the satisfactory solution of the seal problem, the centrifugal compressor may be made as low as two stage and driven by electric motor through a speed increasing gear.

The electric-motor drive, however, has one serious drawback, namely the cost of electrical energy at the point of use is very high in comparison with the energy cost of that contained in the gas being handled in the pipe line, even when considering the cost of gas at the final delivery station. However, the electric-motor drive deserves consideration where the power is already available, such as the Big Inch lines previously used for oil and gasoline transportation. In this case the reduction in original installation cost and the lower cost of service and maintenance will overcome the added cost of the electrical power.

The steam turbine presents undesirable requirements and is therefore not considered as a satisfactory drive. In order to obtain good efficiency it would be necessary to operate condensing and in most cases there would be no condenser water available. If noncondensing operation were used, the water requirement for the boiler would still exist even at the cost of lower efficiency due to noncondensing operation. The boiler required for generating steam with the necessary boiler feed water equipment and other auxiliaries would still place an appreciable demand on service and maintenance, which would not be conducive toward the automatic station.

This brings us to the last noted means of driving the centrifugal compressor, which is the gas or combustion turbine. In energy cost the gas turbine for natural-gas pipe-line work can favorably compete with the gas-engine-driven reciprocating compressor. The gas turbine operates at speeds high enough to permit direct drive to the centrifugal compressor, resulting in a unit with a minimum number of parts all having rotary motion.

Low Maintenance Cost

This type of equipment will permit low maintenance and low service cost, and with some engineering development the automatic compressor station is within reason. With the use of the gas from the pipe line and the low maintenance and service cost the gas-turbine-driven centrifugal compressor appears to be the ideal installation. Technical development and progress has not permitted the application of this type of equipment up to this time. Our major point of interest is to note what progress has recently been made, and to what extent this progress warrants the consideration of the gas turbine as a practical prime mover in the field of gas transportation.

Much has been written about the early date of the first concept of the gas turbine. We will therefore confine this discussion to the recent developments which influenced the adaptation of this type of equipment. The earliest practical application of the gas turbine was the turbosupercharger for aircraft engines and was developed in the twenties and early thirties. The progress in this early period was slow but steady, and by the time World War II started some progress had been made in efficiency and endurance. The demands of the war, with the heavy increase of speed and power of aircraft engines, accelerated the rate of progress to a high degree. Permissible turbine inlet temperatures on the turbosupercharger went up with the use of better heat resisting materials until 1,600° F. was reached with satisfactory performance and life of the equipment.

Benefits of Experience

The technique of manufacturing was greatly improved, which resulted in decreased cost and greater reliability. Most of these improvements were the result of the vast experience with the manufacture and application of this equipment and the concerted effort of the scientific and engineering personnel connected with war research. To show the extent of some manufacturing experience, Allis-Chalmers alone built over 100,000 turbosuperchargers for the armed forces during World War II and these units aggregated in excess of 16,000,000 hp.

Another war product which played

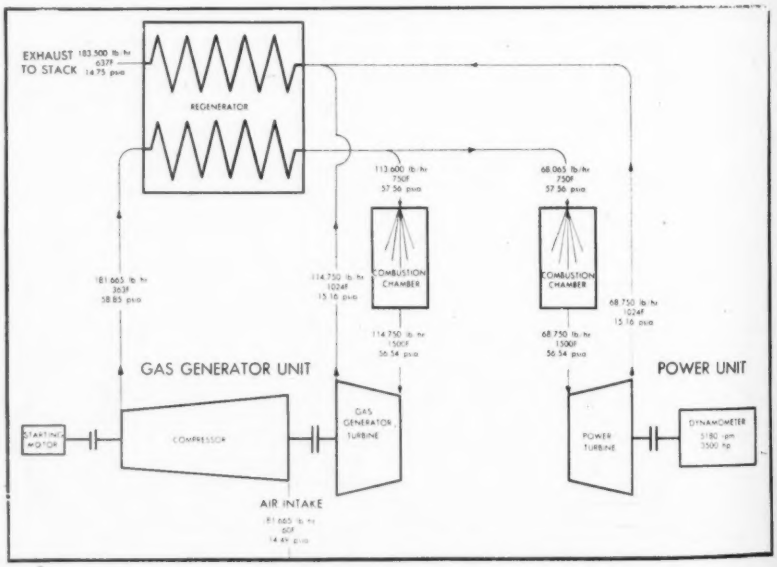


Fig. 3—Cycle diagram for Allis-Chalmers experimental gas-turbine unit at the U. S. Navy Engineering Experiment Station, Annapolis, Md.

an important part in the development of the gas turbine was the jet-propulsion units as used in jet planes. The rate of progress in this field can be emphasized by a few facts of history. At the outbreak of the war there were no turbo-jet propelled planes capable of taking off and flying even a reasonable distance. Fighter planes of the reciprocating-engine and propeller type had a cruising range of only a few hundred miles. Shortly after the conclusion of the war a jet-propelled P-80 flew nonstop across the continent (over 2,400 miles) in approximately 4¼ hours.

The early gas turbines used for jet propulsion had a centrifugal compressor such as the British Whittle-type engine as used on the P-80 Lockheed "Shooting Star." A number of DeHavilland type H-1 jet-propulsion aircraft engine units were built by Allis-Chalmers before the contract was canceled due to the war's end. The higher efficiency attainable in the axial-flow compressor demands that considerable effort be made to adapt this design to the jet engine. The high fuel consumption per horsepower hour of the straight jet engine prevents its immediate use for commercial aircraft although some development work in this field is being carried on at this time. The prop jet has a gas-turbine unit wherein the turbine develops more power than that required for driving the compressor. This excess power is geared to a propeller and the remainder of the energy in the gas flowing through the gas turbine is used for jet propulsion.

Houdry Refining Process

The other major prewar application of the gas turbine was the process unit as used primarily in the Houdry refining process. In this application large volumes of air under pressure are required for burning off carbon deposits on the catalyst, thus the total energy in the air is increased to the extent that it is possible to reclaim, by means of the turbine, sufficient power to drive the compressor which supplied the air at the desired pressure. In many cases this arrangement will produce additional power which can be used for generating electrical energy. The machines for this application are designed to meet the specific process requirement which stresses reliability and constant air supply rather than cycle efficiency.

Allis-Chalmers has manufactured 34 of these units totaling 178,000 gross turbine shaft horsepower. The first of these units was sold in 1937. These units operate at a turbine inlet temperature of less than 1,000°F. and have a record of reliability which is most encouraging.

The above experience gave sufficient encouragement to proceed with the plans for broadening the field of application for the gas turbine. In cooperation with the United States Navy an experimental gas turbine was built to produce 3,500 net horsepower at a turbine inlet temperature of 1,500°F. This unit was designed for the purpose of experimentation with particular attention given to the need for frequent inspection and little consideration given to weight and space limitations. This unit (for plan of operation, see Fig. 3) is now being tested and it is performing well. To date there is insufficient experience to make reliable claims on the endurance possibilities when operating at a turbine inlet temperature of 1,500° F. continuously.

Recently a contract was concluded with the locomotive development committee of Bituminous Coal Research, Inc., to build a locomotive gas turbine which will use coal as fuel, powered by the Yellott process. This unit will be capable of developing 3,750 net horsepower with 80° F. inlet air, a turbine inlet temperature of 1,300° F., and at a speed of 5,600 r.p.m. The cycle will be the simple gas-turbine cycle with a regenerator for improved efficiency.

Fundamental Characteristics

The fundamental characteristics which make the gas turbine a desirable source of power for natural-gas pipe-line work are as follows:

1. It has only rotating parts, therefore service and maintenance requirements are low, permitting a high degree of automatic compressor stations.

2. The rotative speeds are high enough to permit the use of centrifugal compressors directly connected, adding to the possibilities of automatic compressor stations.

3. It can use the gas from the pipe line as fuel which permits the use of low cost energy and eliminates the problem of extra fuel transportation.

4. It does not require water in its cycle of operation.

5. A single (or at most two) unit is capable of producing sufficient power at each compressor station to handle the entire load of a line with 250,000,000 cu. ft. per day gas capacity.

One of the important features for consideration in the design of a gas-turbine-driven centrifugal compressor is to match properly the characteristics of the gas turbine and the centrifugal compressor so as to best fit the pipe-line needs.

For an example, we will consider a 24-in. pipe line designed to handle 250,000,000 standard cubic feet of gas per day, at a maximum pressure of 800 psig. With the reciprocating compressor stations spaced at 100-mile intervals the pressure will drop to about 470 psia. This will result in a compression ratio of 1.73 to 1 and a total adiabatic horsepower of about 6,500. With the centrifugal-compressor stations spaced at 50-mile intervals the pressure will drop to 665 psia. suction, resulting in a compression ratio of 1.224 to 1. These conditions would require about a 2,200 adiabatic horsepower load at each compressor station or a total of about 4,400 adiabatic horsepower per 100 miles of line. This is a saving of over 30 per cent in adiabatic horsepower. While it is true that the over-all efficiency of the reciprocating compressor and gas-engine station will be appreciably higher than the gas-turbine-driven centrifugal compressor, it certainly will not be sufficient to overcome this entire advantage. These facts are not intended to detract from the major reason for considering the gas-turbine-driven compressor station, which is the possibility of approaching the automatic station made feasible by the inherent characteristics of rotating machinery.

Another decided advantage of the centrifugal compressor is that one machine is capable of handling the entire load of a 250,000,000 cu. ft. per day line at the elevated pressures contemplated. This will result in very low floor space requirement.

In the above pipe-line example, if it is desired to place the stations at 50-mile intervals a two-stage centrifugal compressor with 16-in. diameter, backward bladed impellers, operating at 8,100 r.p.m. would perform the required compression duty. However, the required 3,200 b.hp. at 8,100 r.p.m. is a bit high for the present contemplated design of gas turbines. The job could be done with two two-stage units operating in parallel, as the impeller widths would still be within the recommended design limitations. This same job could also be done with two single-stage units operating in series, with the units identical in design.

With the automatic station it may be well to consider a larger number of compressor stations along the line. Spaced at 40 to 43-mile intervals, a single-stage centrifugal compressor operating at about 7,300 r.p.m. could be designed. In this case the speed and brake horsepower (about 2,700 b.hp.) are such that they could be met with a single gas turbine and still be within the present-day design limitations. This would require only one unit per station and undoubtedly result in a more economical design.

Many Problems Still Exist

There are still many technical design problems to be overcome before this type of equipment can be widely used; these mainly deal with the centrifugal compressor. The foremost being the shaft seal, as the usual design for a centrifugal compressor involves a shaft passing through both ends of the compressor casing, and obviously leakage must

Welding of A. P. I. Drill Pipe Joints

The following procedure is used extensively for the welding of standard A.P.I. drill pipe joints:

Both the pin end (male joint) and box end (female joint) are tightened in a lathe under 15,000 foot pounds. This assures a tight seating of the threads so as to secure their maximum strength. (Some producers who weld their joints in the field and do not have the necessary equipment for tightening the joints eliminate these operations.)

Pin End. One is shown being welded in Fig. 1. The procedure is outlined in Fig. 2. The coupling is welded to the pipe with ¼" "Fleetweld 5" electrode. This is a roll welding operation with the welding operator doing the rolling with his left hand. Both ends of the pipe are mounted on rollers to facilitate turning and the pipe is turned by the welder with a standard pipe turner with a handle about two feet long. Three passes are made, producing a bead which slopes down from the top of the coupling shoulder to the pipe at an angle of about 30 degrees. A completed weld is shown in Fig. 3.

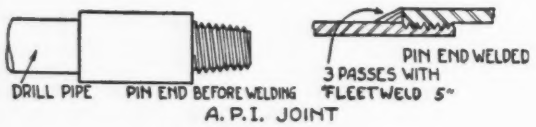


Fig. 2. Pin end procedure.

Box end. It is shown in Fig. 4. Two beads are first made with "Fleetweld 5" electrode for strength purposes. A copper back-up clamp is then used to apply a wear-resisting shoulder with a flat face up to the level of the joint. This weld, made with "Wearweld" electrode, provides a hard flat surface which is desirable at this point because this is the point of contact with the elevator and is therefore the surface that must bear the entire load of the string below it, (when pulling out of hole). The back-up clamp shown in Fig. 5, is positioned between the clamp and the joint is filled up to the edge of the joint with "Wearweld" electrode. This is a roll welding operation, the rolling performed by the welder.

Fig. 1. Welding pin end of joint.

Some shops preheat the joint to 600°-700° before welding.

Engineering assistance on the reclamation of tool joints and other welding problems may be obtained by contacting The Lincoln Electric Company, Dept. 204, Cleveland 1, Ohio.

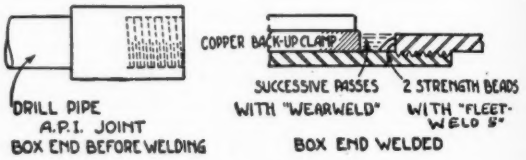


Fig. 4. Box end procedure.

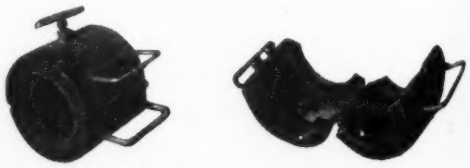


Fig. 5. Copper back-up clamp for box end.

Fig. 3. Completed welds on pin ends.

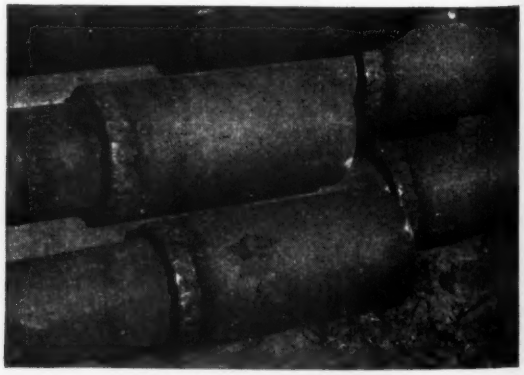


Fig. 6. Completed welds on box ends.

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be prevented at these points. Some compressors are so arranged that the shaft passes through the casing at one end only. With the single-shaft seal and multistage design it is necessary to mount the bearings and the lubricating system inside the compressor casing under an ambient pressure substantially equal to the intake pressure of the unit. (See Fig. 2). The unknown factor in this design is the rate of lubricating-oil loss to the system when operating at the high ambient pressures. For a single-stage compressor with an overhung impeller, or a multistage compressor with two shaft seals it is possible to design the bearings and lubricating system in an ambient atmospheric pressure. This design would require a separate oil pump to supply high-pressure oil to the seal.

The shaft seal is an absolutely vital part of the equipment and, for the very high pressures involved, is a difficult engineering problem. Previously it has been one of the stumbling blocks in the application of centrifugal machines to this particular service. In our opinion the present-day progress in seal design indicates that this problem can be solved by engineering research.

Lubrication for both the turbine and compressor must be protected against interruption by any cause. This would require a positive circulating means for regular service plus an emergency storage device to supply oil to bearings and seals while emergency measures are being put into effect or the unit comes to a standstill. The form of lubricating facilities will vary with the type of installation, but should preferably include a lube-oil circulating pump driven from the main unit plus a small standby or auxiliary pump and supplemented by the emergency storage apparatus referred to above. Means should be provided to keep the lubricating oil always under atmospheric pressure to avoid undue foaming due to absorption gas being handled by the compressor.

If a single-seal compressor is used in which the lubricating system is operating under suction pressure, the lubricating system of the gas turbine must then be completely independent of that of the compressor.

This study is extremely limited and due to the fact that no units, of the gas-turbine-driven centrifugal compressor type, have ever been built for gas-pipe-line work no definite design conclusions can be drawn at this time. The problem requires thorough study for a good understanding of the over-all picture and almost unlimited cooperation of the parties involved for the best solution of the technical problems to be encountered.

Report on Pipe-Line Flow

CHICAGO.—Initial progress report on the new study of pipe-line flow sponsored under a cooperative agreement between the American Gas Association and the U. S. Bureau of Mines was made at the association's natural gas department here April 30. The report was delivered by J. William Ferguson, senior natural-gas engineer of the U. S. Bureau of Mines, Amarillo, Tex.

Heading the pipe-line-flow committee of the A.G.A. is C. H. M. Burnham, vice president and chief engineer of Panhandle Eastern Pipe Line Co., and, besides Ferguson, the group is composed of 11 other prominent transmission and gas technologists.

The present or interim progress report discussed a review of the literature on gas-pipe-line-flow studies and analyses of flow equations. Other projected phases of the committee's work will include studies of fundamentals, analyses of flow factors (in the laboratory and on comparatively short sections of pipe lines), field studies on long pipe-line systems, and correlation of data and development of conclusions for gas-flow engineering.

In this long-range project, which has as its ultimate objective the formulation of an accurate method for calculation of capacities of natural-gas pipe lines under a wide range of operating pressures and flow rates, the A.G.A. will bear the major cost of the project. The U. S. Bureau of Mines will furnish housing, transportation, laboratory equipment, as well as the experience of Bureau engineers. It is anticipated that approximately 3½ years will be required to complete all phases of the project.

Company Officials Queried

In presenting the first report, concerned with the review of literature and present usage of flow equations, it was stated that letters were written to 24 gas-company officials to obtain information on current application of flow equations in addition to surveying all published and available data and theory.

The first portion of the committee's report discussed the general flow equation:*

$$Q = 1.6156 \frac{T_o}{P_o} \left[\frac{(P_1^2 - P_2^2)\, d^5}{GTLf}\right]^{1/2}$$

in which Q = volume of gas in cubic feet per hour, at pressure base of P_o and temperature base of T_o, with

T_o = temperature base defining 1 cu. ft. of gas, °F. absolute.
P_o = pressure base defining 1 cu. ft. of gas, psia.
P_1 = inlet pressure, psia.
P_2 = outlet pressure, psia.
d = internal diameter of pipe, in.
G = specific gravity of gas (air = 1.0
T = temperature of flowing gas, °F. absolute
L = length of pipe, miles
f = coefficient of friction, no units.

The report included a list and discussion of seven basic assumptions which are involved in the general flow equation. It was stated that, considering the pipe-line flow problem in its entirety, and with the present uncertainty in friction factors, it appears that a tolerance of at least ±2 per cent and possibly as much as ±5 per cent is needed. The significance of this tolerance is that not more than three significant figures are justified in any computation of the flowing quantity from known pressure conditions in a given pipe line.

Because the primary difference between various formulas for calculating the flow of fluid in pipes is in the value of the friction factor, the latter portion of the subcommittee's report presented a review of this phase of fluid flow work. The friction factors advocated by various authors of gas-pipe-line-flow formulas fall roughly into two classes:

1. Friction factors assumed to be constant for a given pipe size regardless of flow rate, and

2. Friction factors which vary with Reynolds number, but which disregard the effect of relative roughness of the pipe surface except for an experience or efficiency factor.

Flow formulas using Class 1 friction factors include the Weymouth, California, Towl, Rix, Pittsburgh, Cox, Oliphant, Unwin (A) and (B), and Spitzglass. In an appendix to the report was outlined a tentative method for solving pipe-line-flow problems by the equation developed by C. P. Colebrook.

*Johnson, T. W., and Berwald, W. B., Flow of Natural Gas Through High-Pressure Transmission Lines: Bureau of Mines Monograph 8, 1935. Also Bureau of Mines Report of Investigations No. 3153 (1931).

Dry Ice Studied

Possibility of manufacturing dry ice from carbon dioxide found in large volumes in a well in North Baxter gas field, near Rock Springs, Wyo., is being studied by Mountain Fuel Supply Co., according to the company's annual report.

Spotting Pipe-Line Troubles At 100 Miles Per Hour

*by G. F. Leamon**

ON almost every airport that we land our plane, someone learns that we are patrolling pipe lines, and then the questions start. What do you look for? How do you find leaks? Pipe-line personnel know the answer to those questions, and also that there are many other things to report besides just leaks.

First, I'd like to describe how the pipe line looks from the air. Those who have never before flown will be amazed at the ease of following a line. The pipe line shows up as greener, darker, lighter, dryer, or wetter, or in the case of snow, has more or less snow over it than the ground adjoining the line. In other words, there is a definite contrast between the pipe line and the surrounding soil. This is one of the advantages of such an air patrol. On the ground it is often impossible definitely to locate the line, while from the air, trained personnel have no difficulty in pinpointing the line. Our patrol is conducted at speeds from 90 to 100 m.p.h. A person who has never flown will say that this is too fast, and I may be able to describe the feeling of speed in this manner. In riding in a train and looking out the window, you have observed the fence posts in the right-of-way going by at a terrific rate of speed, much too fast to count. Yet, you can easily count the posts of a fence 200 or 300 ft. away from a train. The same is true in flying. If we were to "buzz" the ground at 25 or 50 ft. we would be able to observe nothing, while at an altitude of 300 or 400 ft. we experience no difficulty in locating and reporting troubles on the pipe line.

We have found that, at least in the parts of the country covered by Panhandle Eastern and the Northern Natural lines, air patrol can be flown on a year-around basis, with almost time-table-like precision. Although mud and snow may hamper the walker, only very poor visibility and ceilings will delay the aerial patrolman. For all practical purposes, delays in air patrol can be disregarded as they occur so infrequently, and are usually made up on that same trip.

Last fall down in Texas extremely heavy rains uncovered some of the pipe lines, and the extent of the damage was not known. Although the rain was continuing, the patrol plane was sent out to patrol areas where the heavy rain had been recorded, and 2 hours later reported back the locations and an estimate of damages at each point where damages occurred. It is doubtful if such a check of the lines could be made by other means of patrol in less than a week's time. On this same day food and coffee were flown in to a marooned crew, engaged in repairing a washed-out line.

Troubles Other Than Leaks

The aerial patrol can and does report leaks, some being so small that the pipe must be soaped to find them. The first year's patrol over the Panhandle System reported 141 leaks, and subsequent checking in the field proved the patrolman to be 90 per cent correct. Other troubles of primary importance reported by the air patrol are washes, and construction endangering the lines. The following data were taken from aerial-patrol reports covering a period of 12 months and approximately 60,000 miles of pipe line patrolled for Panhandle Eastern, and a period of 5 months and approximately 17,000 miles of pipe line patrolled for the Northern Natural system.

	Panhandle Eastern Jan. 1946 to Jan. 1947	Northern Natural Aug. 1946 to Jan. 1947
Leaks	141	32
Washes	301	36
Faulty backfill	24	20
High water	49	11
Const. endangering lines	100	58
Eroding fields	16	0
Streams endangering lines	15	4
Clogged tile	1	0
Pipe-line appurtenances	43	8
Lines exposed	36	5

Practically all the leaks investigated and repaired were of the small pinhole variety. Washes reported included all washes, even though small, close to or on the pipe line, and those working toward the pipe line although some distance away from the right-of-way. The soil in the rough country in eastern Kansas, all of Missouri, and western Illinois which is traversed by Panhandle Eastern pipe lines is by far the most susceptible to erosion of any which we cover. Pipe-line appurtenances include disarranged covers over farm tap meters, styles and line-marker posts out of plumb, gate valves, meter, and regulator-station fences that have been disturbed by cattle rubbing against them, etc.

The ground patrolman's vision and observation are often limited to a few feet on either side of the line. Due to his bird's-eye point of view, the aerial patrolman is definitely at an advantage in observing washes that originate off the line, and in reporting them before they can cause damage to the right-of-way. It seems as if someone is continually building something over or near the line that would be hazardous to the pipe line and to the builder, and such construction can usually be reported in time to eliminate the hazard.

The cost of air patrol generally runs between 16 and 20 cents an air mile, depending of course, on the individual line concerned. Based on the above, a line 1,000 miles in length may be patrolled up and back twice a month for considerably less than $1,000.

Some pipe-line companies hesitate to put their patrol in the hands of inexperienced personnel. This is an important problem. There are several concerns doing aerial patrol work, using only experienced pipe-line men. Another method is for the pipe-line company to furnish the observer for each trip, and this of course will increase the cost of patrol. Regardless of the method used, we have found that it is a desirable policy to have the pipe-line foremen and division superintendents patrol over their sections of the line three or four times a year.

The aerial patrol contractor handles or takes care of all work pertaining to the patrol such as scheduling of flights, performing flights, and submitting reports. Patrol schedules are sent to the pipe-line department about a month in advance, and the patrolman is notified a few days in advance as to what stops he should make in order to pick up observers. At the end of each day's flight, reports are made covering that day's patrol. Reports are broken down into districts or divisions, copies going to the foreman, division superintendent, and the superintendent of pipe lines. The report form includes the following: Pilot, plane, date, weather, take-off time, landing time, lines patrolled (including mileage), and troubles reported.

In the case of trouble requiring immediate action, landings are often made at a compressor station, or near a farm house, or any place where telephone communications can be found, and a call placed to the nearest pipe-line office. Two-way radio equipment will be installed when it becomes available, and the aerial patrol will be able to talk directly with mobile and fixed stations operated by the pipe-line company.

*Leamon Flying Service, Kansas City, Mo.
A paper presented at the annual spring meeting of the Natural Gas Department, American Gas Association, Chicago, April 30-May 1.

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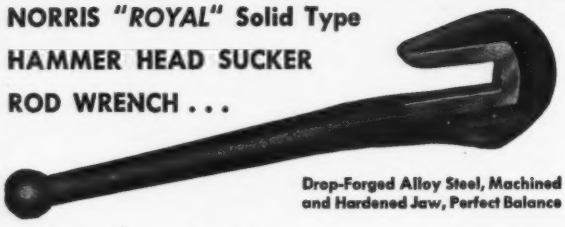

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Operating Experiences with

ANGLE-TYPE COMPRESSORS

by O. H. Moore

This article presents a brief descriptive history of the Tennessee Gas & Transmission Co.'s compressor stations, and points out certain features and shows their effect on the operation of the equipment. The author is vice president of T. G. & T., with headquarters at Houston. The article was presented as a paper at the annual spring meeting of the Natural Gas Department, American Gas Association, Chicago, April 30-May 1.

DUE to wartime restrictions, only 7 of the 14 stations originally planned for the Tennessee Gas & Transmission Co. pipe line were completed in October 1944. The average spacing between stations in this construction program was approximately 168 miles. The initial capacity was 207,000 M.c.f. of gas per day at a pressure base of 14.73 psig. with discharge pressure at each station set at 750 psig., and a compression ratio of 1.83. In the finished line, 15 stations will be constructed, spaced approximately 84 miles apart and will operate on a compression ratio of 1.5.

Fifty-eight 1,000-hp. angle-type units were installed in the original seven stations. Four new intermediate stations were constructed on the east end of the line and put into service in January 1946. Thirty-one angle-type units, totaling 33,600 hp. made up of 1,000 and 1,200-hp. units were installed in these four stations.

The installation of one additional angle-type unit was made in each of Stations 8 and 14 in December 1945. Eighteen angle-type units, totaling 19,400 hp., were installed in Stations 6 through 14 and placed in service during November and December 1946. Eleven stations are now in operation with a total of 113,000 installed horsepower, and three manufacturers' makes of engines are represented in the 109 compressor units now in service.

Three additional stations are at present under construction on the south end of the system, and are scheduled to be in operation by mid-1947. These three stations will have a total of fifteen 1,600-hp. horizontal-type units with a combined installed horsepower of 24,000.

The three principal factors of design, given by B. R. Bay in his paper "Compressor Station Problems" presented before the American Gas Association convention in 1934, namely:

1. Provide plenty of good cooling water
2. Provide correct lubrication.
3. Supply clean air for the power end and clean gas for the compressor end.

are built into each compressor station on the pipe line. Water wells with adequate supply of water and of very good quality were developed at Stations 1 through 9. Water for the remainder of the stations is furnished either from rivers or reservoirs. Two enclosed jacket-water circulating systems and one open system are provided at each station. One jacket-water system provides for the cooling of the power cylinders, and the rate of circulation is sufficient to maintain a temperature spread of 10° F. between inlet and outlet. A second enclosed system provides for the cooling of the compressor cylinders and the oil coolers. A 20° F. difference in temperatures is maintained between the two enclosed systems. The circulating rate in the compressor cylinders and oil coolers was designed to have a temperature difference of 20° F. between the inlet and outlet. However, in actual operation, the difference is 6° to 10° F.

A very flexible mechanical-draft cooling tower provides cooling for both the jacket water and the main line gas. Each tower is equipped with three deep-well-type pumps and three circulating fans. This arrangement in the tower permits a close control on operating temperatures.

Oil-bath-type air cleaners are installed on the free-air intake lines to each engine. The advantage of these cleaners was well demonstrated at the time each station was placed in service. All vegetation in the immediate vicinity of the main building had been killed during construction, permitting a continuous dust storm under each air cleaner, until the station yards became well sodded. This dust condition was extremely heavy at Station 4, requiring repeated cleaning of the air cleaners. Even with this precaution, enough dirt was pulled into the scavenger cylinders to cause piston seizure. To keep the engines on the line, it was necessary to increase the piston to cylinder clearance. This dust trouble does not exist in the station since the yards have been well sodded.

The incoming gas to the compressor station passes through a battery of dust scrubbers where intimate contact is made with the incoming gas and the scrubber oil in order to wet any dust and foreign particles and prevent their passage through the sys-

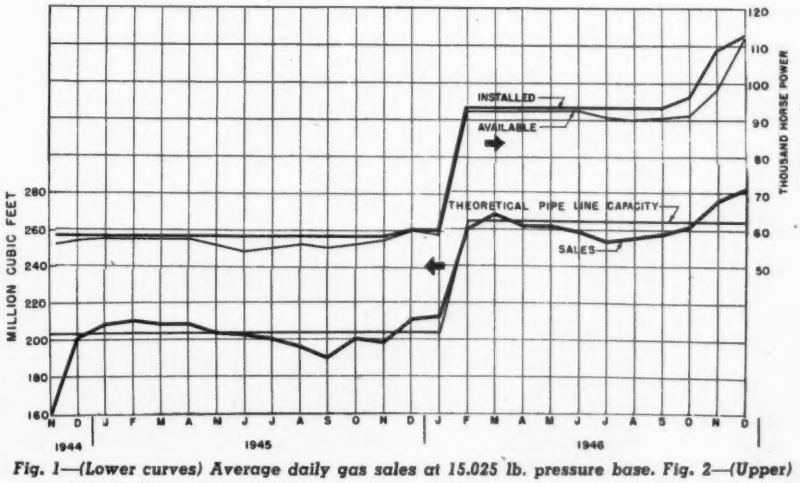

Fig. 1—(Lower curves) Average daily gas sales at 15.025 lb. pressure base. Fig. 2—(Upper) curves) Available and installed horsepower (available horsepower corrected for mechanical downtime)

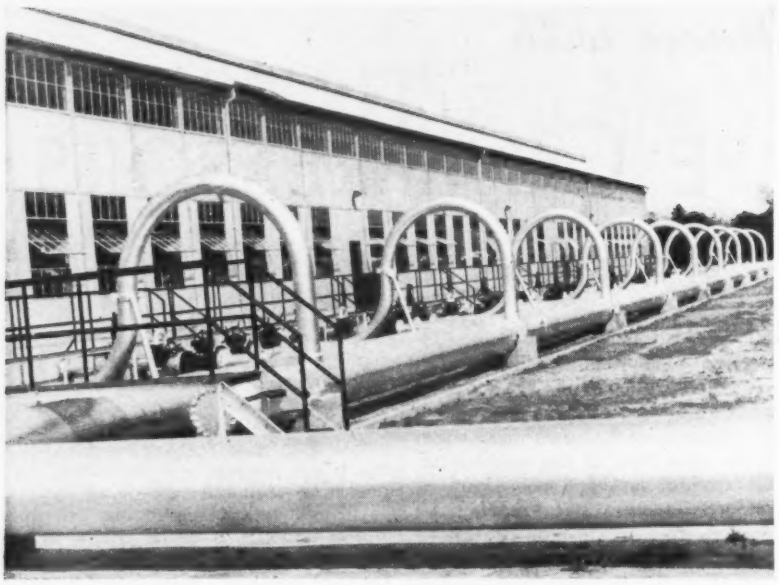

Fig. 3—Discharge bends at Station No. 6, Monroe, La.

tem into the compressor cylinder. The gas entering the lower chamber of the scrubber causes the oil to be depressed, exposing the ends of slotted tubes. These tubes act in much the same manner as a bubble tray and cause the gas to be intimately contacted with scrubbing oil as it passes up through the tube. The gas then passes through a Mist-D-Fier section where the entrained liquid is thrown out, and the scrubbed cleaned gas leaves the scrubber through the top 12-in. outlet connection. The scrubber oil is continually going through a cycle of contact and draining back and in the process collects the dust and foreign matter from the gas. Oil-settling tanks are provided for periodically settling of the scrubber oil from each scrubber.

Every effort was made thoroughly to clean the pipe line prior to placing it in service, but even at best a lot of foreign matter was left in the line and the scrubbers were heavily taxed at the starting of operation. One experience at No. 8 Compressor Station demonstrates rather clearly the advantages of the scrubbers. In that particular instance, so much mud, water, and foreign particles were knocked out in the scrubbers, and then into the settling tanks, that the drain valves in the bottom of the tanks had to be opened and the mess turned loose on the ground after all available containers were filled. During this entire period the compressor units remained in operation and never missed a beat.

After the first month of "feeling out operation," the total gas sales were stepped up to the maximum capacity and the daily average send-out for the balance of the winter 1944 and 1945 months equaled or exceeded the estimated pipe-line capacity. Valve-plate breakage, compressor ring, and rod packing troubles were relatively small considering that there were 58 engines in full operation. Incidentally, this good fortune was rather opportune as the spare part bins were not too well stocked with repair items.

Figs. 1 and 2 show graphically the efficiency and dependability of the angle-type compressor units. The actual total sales exceeded the theoretical pipe-line capacity several months during the 2½ years of operation. The available horsepower almost equaled the installed horsepower during the periods of peak demand.

Reclaimer-Type Oil Filters

Each station is equipped with two reclaimer-type oil filters, with one reclaimer installed in each end of the main building basement. All engine crankcases are manifolded to pipe headers which permit the filtering of the oil in each engine on the bypass principle by simply switching valves. A schedule has been set up at each station to allow the oil in each engine to be processed a definite number of hours in the reclaimer each day. Samples of oil from the engine crankcases are sent to the laboratory at least once each month for analysis. Table 2 shows how well these reclaimers are doing their job. With the exception of one station, the crankcase oil has not been changed at any of the plants since the beginning of operation. One reclaimer of the same type as used in the main engine room, but smaller in size, is installed in the auxiliary building for processing crankcase oils from the auxiliary engines.

The advantages of properly cleaned suction headers were well demon-

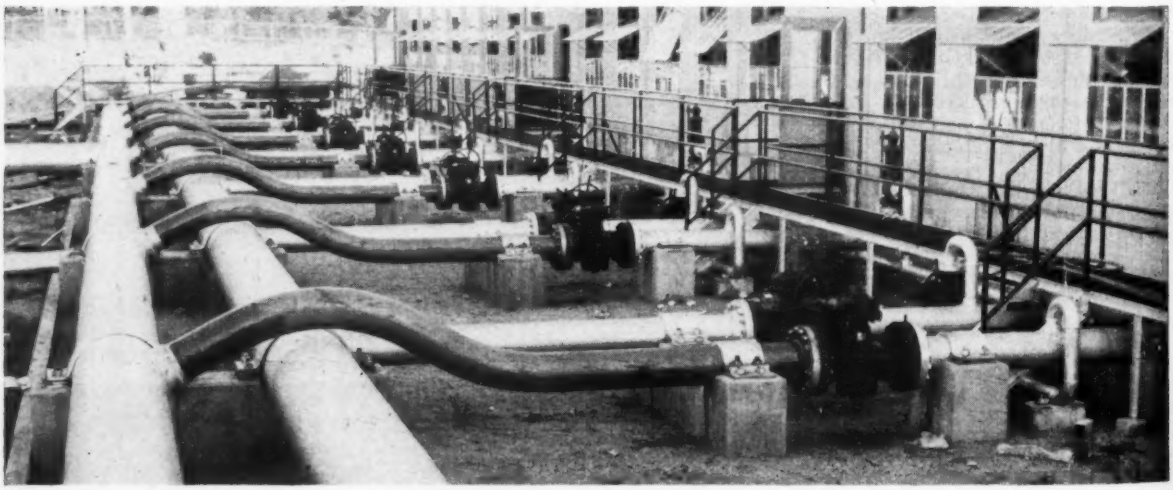

Fig. 4—Discharge bends at Station No. 12, Campbellsville, Ky.

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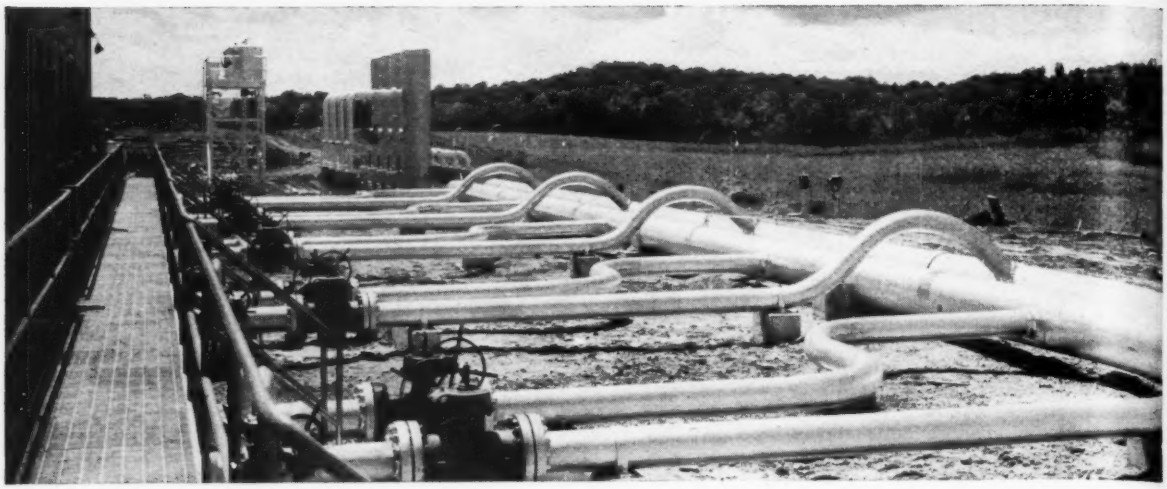

Fig. 5—Suction and discharge connections at Station No. 13, Winchester, Ky.

strated at two stations that were placed in operation in January 1946. In these particular stations, the suction header is on two elevations, the section of the header at the scrubbers is lower than the section alongside the compressor building. These headers were blown in the same manner as those at the other plants, yet valve-plate, compressor-ring, and rod-packing replacements were very heavy in comparison to the other stations. It required several additional blowings to clean the headers sufficiently to eliminate excessive cylinder wear. In a study of this problem to determine why these two plants gave so much trouble, it was revealed that these headers were loaded during very cold weather, and it is apparent that the difference in elevation of the two sections of the headers coupled with a hard freeze prevented a thorcugh cleaning job. This condition was not present at the other plants because the headers were loaded during mild weather.

Reducing Oil Consumption

After several months of full load operation in the initial stations, a number of engines were examined for mechanical trouble. Failures were found to vary considerably with the make of engine. The connecting-rod bearings in one type engine were failing rapidly. This was found to be caused by bearings being too loose and was eliminated by a change in the method of tightening. The manufacturer has since furnished a new design which is proving very satisfactory.

Vibration set up in the fly wheel in one type engine at certain critical speeds, and it was necessary to install vibration dampers to eliminate this trouble. This vibration was caused by a very heavy wheel supplied by the manufacturer in order to permit a wide range of operating speed, which incidentally is not required in the operation of this pipe-line system. A lighter wheel which operates through the required speed range is now being furnished by the manufacturer, and has proved very satisfactory.

The scuffing of cylinders and pistons was found in another make engine which has apparently been eliminated with a change in the direction of rotation, a proper balance of the load between the power cyl-

(Continued on page 74)

TABLE 1—ANALYSIS OF RAW WATER SUPPLY
(Mineral substances as determined, p.p.m.)

Stations—	2	4	6	7	8	9	10	11	12	13	14
Silica	19.60	37.60	1.20	6.00	18.00	1.00	.20	12.80	11.00	24.60	37.00
Iron	....	....	....	1.80	18.20	....	....	3.60	1.00	15.40	....
Alumina	1.80	1.60	19.00	....	....	....	....	....	....	....	11.20
Magnesium	.52	.13	.83	.32	3.77	17.27	.22	8.15	2.36	13.62	8.52
Calcium	13.63	2.00	2.00	1.20	11.02	14.04	3.61	6.52	8.42	7.22	32.48
Sodium	....	....	....	....	....	....	....	....	....	....	60.26
Bicarbonates	103.70	192.80	76.98	205.00	170.80	158.60	122.00	89.40	122.00	73.20	97.60
Carbonates	....	....	1.80	9.00	....	....	....	....	....	....	....
Chlorides	60.00	50.00	36.00	30.00	16.00	10.00	10.00	12.00	14.00	30.00	42.00
Sulfates	76.53	148.55	17.69	75.22	34.01	84.35	....	1.65	32.09	15.22	103.69
Total solids	435.00	345.00	328.00	378.00	303.00	222.00	165.00	145.00	223.00	230.00	300.00
pH	7.40	7.70	7.80	8.40	7.00	7.80	7.00	...	7.30	7.50	7.10
(Hardness as $CaCO_3$ grains per gram)											
Hardness	2.09	.41	.287	.24	2.53	6.31	.57	2.97	1.78	4.33	6.16

TABLE 2—ANALYSIS OF CRANKCASE OILS

	Gravity	Visc. at 100° F.	Visc. at 210° F.	Pour	Color	Neut. No.	Carbon residue	Service hours
Station 2:								
New oil	28.9	505	62.4	...	2.5	.01	.01	
Used oil	28.0	655	69.9	...	3.5	.05	0	18,960
Station 4:								
New oil	29.0	532	65.0	10	3.5	.06	.26	
Used oil	29.8	...	65.0	...	9.25	.02	.12	18,962
Station 6:								
New oil	26.3	510	61	10	3.0	.05	.2	
Used oil	29.4	532	65.4	0	4.0	.03	.08	18,100
Station 8:								
New oil	27.3	600	68.0	10	5	.02	.05	
Used oil	29.2	605	69.0	...	...	.13	.20	18,960
Station 9:								
New oil	27.3	610	67.3	5	3	.02	.10	
Used oil	27.7	632	67.8	7.5	...	.28	...	7,920
Station 10:								
New oil	27.9	459	59.8	5	3	.02	.08	
Used oil	28.4	475	62.3	5	7.5	.08	.12	18,960
Station 11:								
New oil	22.3	850	66.0	10	3.5	.1	.30	
Used oil	22.4	...	63.1	...	6	1.5	...	7,920
Station 12:								
New oil	27.3	610	67.3	5	3	.02	.1	
Used oil	27.8	611	68.1	0	6.5	.12	.17	17,160
Station 13:								
New oil	29.4	698	76.1	10	4.5	.03	.26	
Used oil	29.4	726	77.2	...	...	.07	...	8,760
Station 14:								
New oil	27.3	610	67.3	5	3	.02	.1	
Used oil	27.6	625	67.5	0	8	.08	.18	15,680

WELL-HEAD PRICE FIXING

by Glenn W. Clark*

RECENTLY the Oklahoma Corporation Commission issued two orders† fixing the price of natural gas at the well head. One of these orders (No. 19514) is legislative in character and, if valid, will affect every producer of natural gas in the Oklahoma portion of Hugoton field. It requires "that no natural gas shall be taken out of the producing structures or formations in the Guymon-Hugoton field in Texas County, Oklahoma, at a price, at the well head, of less than 7 cents per 1,000 cu. ft. of natural gas, measured at a pressure of 14.65 psia."

The going field price at the well head in Guymon-Hugoton field is approximately 4 cents per 1,000 cu. ft. of gas and the effect of these orders, if valid, will be to increase that price, on the basis of measurement now generally in use, to approximately 7.84 cents per 1,000 cu. ft.

The legal question, both state and federal, embraced within the Oklahoma orders, are numerous and are in issue in legal proceedings in which my company and others now are engaged to test the validity of those orders. Therefore, it would ill behoove me at this time and place to treat specifically with those particular orders or to assume a legalistic or dogmatic attitude with respect to those legal questions. Specific reference to these orders have been made by me only because of their precedent making possibilities and because of the wide interest they have created. I will deal with my subject in a more general way, from the standpoint of fundamentals as I view them, and will speculate briefly on some of the problems which might attend state endeavors to fix well-head gas prices.

Public Resists Price Fixing

Except with respect to a limited field, such as that occupied by public utilities, nation-wide interest has attended every attempt of a state to fix the price at which a commodity or service may be sold. This interest, I think, springs from a basic concept of legal limitations on price fixing which has been engendered within us over a long period of years, but the foundations of which largely have been obliterated during a very short period of time.

The police power of a state is the power of sovereignty, the power to govern men and things within its dominion. It is by virtue of this police power that a state may legislate to fix prices. The exercise of every private right will in some manner affect the public, and conversely, the exercise of the police power of a state must to some extent abridge the liberty or affect the property of a citizen. Subject to constitutional restraints, the private right must yield to the public need. The fourteenth amendment of the Constitution does by no means stand as an absolute barrier against price fixing by a state. The extent of its restraint always is a puzzling question because it varies in final analysis with changing interpretations by the Supreme Court of the United States.

I think most of us have believed, and rightly so, until recent years, that the power of a state to fix the price of a commodity or service is limited far more drastically by constitutional provisions, both state and federal, than now appears to be the case.

Early Court Decisions

We have recognized it to be axiomatic that commercial price or market value is the essence of property and that whatever takes away or reduces that price, or reduces the bargain of a purchaser under a contract, which is property, takes away, to the extent of the reduction, the property the owner theretofore has had. Moreover, in the court decisions of earlier days we were taught that the Constitution must be interpreted in the light of generic common-law rights, including the right to enjoy and use private property in any manner which will not injure the lawful rights of another.

Under the common law, certain businesses were regulated by the Government because they were "clothed with a public interest." These businesses were such as operated under circumstances constituting them virtual monopolies or under charter granting exclusive privileges, or were the traditional businesses that people in the ordinary course of necessary business or preservation of life or health had to patronize. It always has been difficult for the courts to lay down a working rule by which it may readily be determined when a business has become affected with a public interest, but for many years they have interpreted the fourteenth amendment as prohibiting state price fixing of commodities or services in the ordinary business activities of mankind. This type of regulation has been limited rather strictly to types of industry with attributes similar to those inhering in those industries which, under the common law, were held to be affected with a public interest. One of the earlier leading cases respecting price fixing by a state is that of Munn v. Illinois,* decided in 1877. There it was held by the Supreme Court of the United States that the State of Illinois could regulate the charge of an elevator standing in the throat of commerce and taking toll from all the commerce that passed from the west to the east, a virtual monopoly that had published its rates to the public.

In 1923 Chief Justice Taft, speaking for the Supreme Court, laid down three classes of business said to be clothed with a public interest justifying some public regulation.† These classes were (1) those carried on under a public grant of privileges; (2) certain occupations regarded as exceptional, such as the keeping of inns, cabs, and grist mills; and (3) business, the owner of which, by devoting it to public use, in effect grants the public an interest in that use, and subjects himself to public regulation to the extent of that interest. Further, the chief justice stated:

"It has never been supposed, since the adoption of the Constitution, that the business of the butcher, or the baker, the tailor, the woodchopper, the mining operator, or the miner was clothed with such a public interest that the price of his product or his services could be fixed by state regulation."

Basis of Decisions

This philosphy continued practically unbroken until the case of Nebbia v. New York,‡ decided in 1934, in which the court, in a five-four decision, held that price fixing of milk by a statute of New York was not unconstitutional where, in the absence of such a law, the paramount milk industry of the State of New York would be drastically impaired and the quality of milk endangered.

Had that decision been bottomed primarily upon the preservation of the public health, or had the Supreme Court adhered to the long-accepted interpretation of the case of Munn v. Illinois, there would have been nothing novel in the conclusion

*Vice president and general counsel, Cities Service Gas Co., Oklahoma City.

†Peerless Oil & Gas Co. v. Cities Service Gas Co. and all operators, producers and takers of natural gas in the State of Oklahoma, and particularly in the Guymon-Hugoton field, Cause C.D. No. 1054, Order No. 19514; Peerless Oil & Gas Co. v. Cities Service Gas Co., Cause C.D. No. 1054, Order No. 19515.

*24 L. ed. 77; S. C. Rep. ed. 113-154.

†Chas. Wolff Packing Co. v. Court of Industrial Relations of the State of Kansas, 262 U. S. 522; 67 L. ed. 1103.

‡291 U. S. 502, 78 L. ed. 940.

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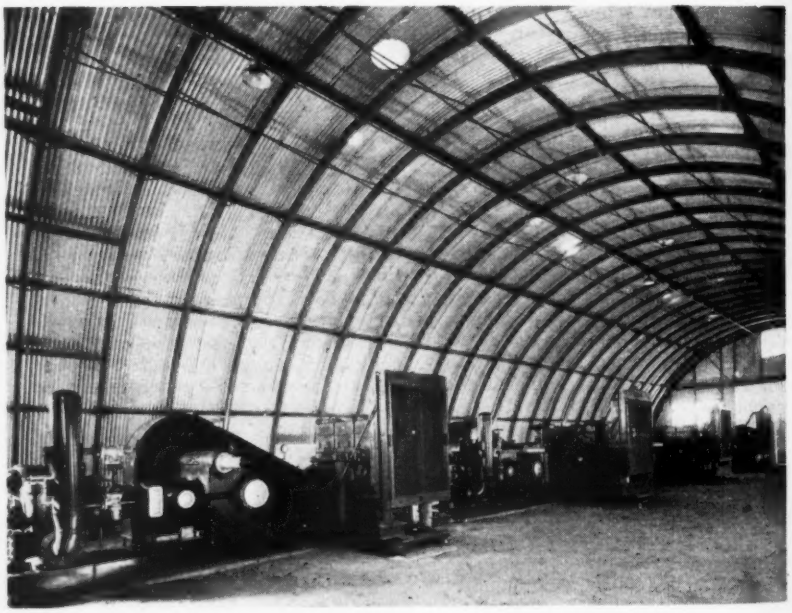

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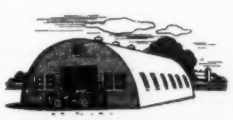

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reached. But the primary justification for the state legislation there in question appears to have been economic necessity arising from an overabundance of milk and consequent destructive competition among milk dealers. And the court not only held, in substance, that there is nothing sacrosanct about the price one may charge for what he makes or sells, but also that the phrase "affected with the public interest" can mean no more than that an industry for adequate reason is subject to control for the public good.

Since the Nebbia case, there have been several instances of price and wage fixing outside the field in which most of us thought that expedient validly could be exercised. In 1941, in a unanimous decision*, the Supreme Court upheld a Nebraska statute fixing the maximum compensation which a private employment agency may collect from an applicant for employment. In that case, Justice Douglas, speaking for the court, said:

"In final anlysis, the only constitutional prohibitions or restraints which respondents have suggested for the invalidation of this legislation are those notions of public policy embedded in earlier decisions of this Court but which, as Mr. Justice Holmes long admonished, should not be read into the Constitution."

He stated further:

"We are not concerned, however, with the wisdom, need, or appropriateness of the legislation. Differences of opinion on that score suggest a choice which 'should be left where . . . it was left by the Constitution—to the States and Congress.' "

I suppose most of us believe that there should be some elasticity in the law, at least to an extent which does no violence to fundamental principles. And certainly, with everexpanding and complicated economy, it becomes more and more difficult to draw the line between a business which is affected with a public interest and one which is not.

Under the present state of the decisions, absent conflict with specific constitutional provisions such as the commerce clause, there would seem to be no lack of inherent power in a state to fix well-head gas prices merely because the gas-producing industry is not one which we have thought to be affected with a public interest. Of course there must be adequate reason for invoking the police power. Moreover, the legislative act must be reasonably related to and designed to accomplish the declared purpose. At least, that has been the declared law over a long period of years. In some recent cases, however, the presumption in favor of state action have been so conclusive, both as to the adequacy of the reason for exercising the police power and as to the appropriateness of the price fixing remedy, that the question of how a court determines whether or not state legislation is so arbitrary or discriminatory as to violate the "due process" clause of the fourteenth amendment is a perplexing one.

Presumably, however, in attempting to give validity to well-head price fixing, a state legislature must find in some way that correlative rights of gas producers and royalty owners are not being protected, or that waste of gas is occurring, or some other reason deemed to be adequate to require additional control of the gas-production business for the public good rather than for the benefit of one small group at the expense of another. If such reason is adequate, the fixing of the well-head price should be reasonably calculated to prevent or reduce the evils which are thought to cause public injury.

Whether such evils exist in any of the gas-producing fields of this nation, and if so, whether the fixing of some higher or lower price than that established by the time-honored law of supply and demand would alleviate the condition, are questions concerning which your knowledge or guess, as the case may be, is as good as mine.

The "Commerce Clause"

The "commerce clause" of the Constitution might prove to be the most formidable obstacle to any state scheme to fix well-head gas prices. In most of the large dry-gas fields of this nation the bulk of the gas produced is sold to interstate pipe-line companies. In the daily and normal course of events, this gas, in many if not in most instances, is on its uninterrupted journey for delivery in other states from the moment it is taken from the well head, or for that matter, from the producing formations. Although there are differences of opinion concerning the matter, there is no dearth of authority to the effect that the first sale of such gas, whether at the well head or at the facilities of the pipe-line company, is a sale in interstate commerce. If the sale is in interstate commerce, it may or may not be subject to the rate-regulatory powers of the Federal Power Commission, depending upon the scope of the exemption provisions of Section 1(b) of the Natural Gas Act. The forthcoming decision of the Supreme Court of the United States in the Interstate Natural Gas Co. case should further clarify the status of field sales of gas for out-of-state delivery. If these are held to be sales in interstate commerce, the scope of the production and gathering exemption of the Natural Gas Act might at long last be defined.

But if such field sales actually are made in interstate commerce, a holding that they are exempt from regulation by Federal Power Commission would not necessarily clear the way for state control of field prices. Federal delay or inaction in occupying a field of interstate commerce requiring uniformity of treatment does not open the door to state regulation.

In any event, it may be credibly assumed that well-head price fixing of natural gas by a state could cause extreme difficulty in the gas-rate regulatory fields of other states and of FPC. Conceivably, the price of gas to pipe-line companies and to ultimate consumers would depend constantly upon sporadic changes in well-head prices.

It is not for me to pass upon the wisdom of any state pricing of well-head gas that validly may be accomplished. However, in conclusion, I suppose it is not inappropriate for me to observe that since gas consumers far outnumber gas producers and royalty owners, the states which attempt well-head price fixing may be inviting federal control, or perhaps I should say the extension thereof, over well-head gas prices.

*O. M. Olsen v. State of Nebraska et al, 313 U.S. 236, 85 L. ed. 1305.

Angle-Type Compressors

(Continued from page 70)

inders, and a change in the grade of lubricating oil. It has been found in the operation of these two-cycle multicylinder fuel-injection-type engines that an unequal balance of the load between cylinders has caused the failure of rings, cylinders, and pistons in the overloaded cylinders.

The exhaust pyrometer was first used as a guide to check the load condition in the various cylinders. The exhaust temperatures, however, were found to be of little value except when taken on engines equipped with dampers in the intake manifold and used in conjunction with the gas engine indicator. In fact they were a detriment until the operators found that the exhaust temperatures from a partially loaded cylinder could be the same as that from a heavily overloaded cylinder. No attempt has been made in the field to take a full pressure-volume diagram with the indicator, principally because of the high speed of the engine and the complicated indicator mechanism. Pull cards showing peak pressures have been resorted to in determining the balance of load between cylinders.

In engines equipped with dampers, the peak cylinder pressures and exhaust temperatures are equalized concurrently. It has been impossible to bring about this balanced condition in the engines not equipped with manifold dampers. They should be operated with balanced peak cylinder pressure as shown by pull cards, and the exhaust temperatures used as a quick means of determining any change in the operating condition of the engine.

One particular problem found in the operation of these engines which has apparently caused cylinder failures is the clogging up of intake ports with carbon which prevents sufficient scavenging air from reaching the affected cylinder. When loss of power is sufficient in some of the cylinders to cause too great an excess load on other cylinders, piston seizure occurs in those overloaded cylinders. Study is now under way toward reducing the oil consumption with the thought of preventing this formation of carbon. A routine inspection schedule has been put into effect in order to prevent sufficient formation of carbon to cause cylinder failures.

Mercury "U" gages are being installed on the scavenger air manifold of each engine in order to have a running record of the scavenger air pressure. It is hoped that this record will point out any variance in the operating condition of the scavenger air system, such as clogging up of intake ports, valve leakage, or clogging up of air cleaners.

Too much cannot be said about having a proper balance of load among cylinders in a multicylinder engine, especially where the equipment is operated at full load practically 100 per cent of the time. There has been approximately 3¼ per cent failure in power cylinders during the 2½ years of operation, and it is the general opinion that these failures have been caused by overloaded condition in the individual cylinders. Power ring replacement has been 1.1 per cent, piston-rod packing 2.8 per cent, and compressor rings 3.2 per cent. These replacements have been over the entire operating period from October 1944 through December 1946.

One real "headache" in the original stations was the vibration in the expansion loop (Fig. 3) in the discharge lines. Knee braces were installed, as shown, permitting completion of the first winter run. These loops were removed in the summer of 1945 and replaced with the installation shown ir Fig. 4. Another design was used in the four stations completed in January 1946, which has proved satisfactory. This design is shown in Fig. 5.

In conclusion, I would like to mention some of the operating incidents prevailing before and during the beginning of operation. The final main line tie-in weld in the initial construction was made in the late afternoon of October 30, 1944, and the delivery of gas from the system started in the afternoon of October 31. This final weld was made in the first 10-mile section of line east of Station 10, and at a point about 1½ miles from the station. High-pressure gas was turned into the section at about 7 p.m. on the evening of October 30, and the block valve at the station opened within a few minutes after the section was purged and loaded. The entire section of 178.7 miles of pipe line between Stations 10 and 12 had been loaded with low-pressure gas resulting in a very high gas velocity past the station when the block valve was opened. It required approximately 4 hours for the pressure to stabilize, at which time, the entire plant was put into operation. A false load had been placed on these engines for only a short time prior to the completion of the tie-in weld, yet the initial operation was carried out with complete success.

It might be of interest also to mention that there were only three men with previous experience in compressor station operation at this plant at the time it was put in service. The remainder of the crew had not even seen the inside of a compressor station prior to their work on the construction of the plant. There was a do-or-die spirit prevalent throughout the system and it contributed greatly to the successful operation of the system.

It is my opinion that 2½ years of operation with angle compressor units is too short a period in which to develop operating information that should be considered as conclusive. The system was constructed and manned during a very critical period with respect to material and personnel. Only 48 out of the original 200 compressor-station employes were experienced in station operation and only a relatively few of these had operated the angle-type units.

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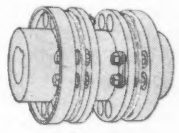
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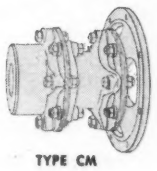
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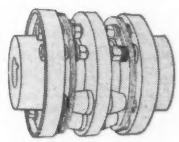
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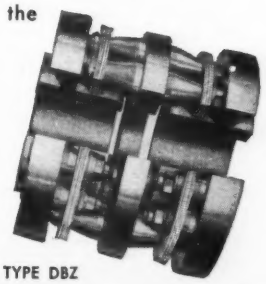
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Stopgap Processes VS. CATALYTIC CRACKING

by Davis Read

The author discusses the economics of several processes which might be incorporated in the processing scheme of an average Mid-Continent refinery to increase octane rating. Stopgap processes are defined by the author as those which will increase octane rating moderately, but which will not permit production of reasonable quantities of 85-octane premium and 80-octane housebrand gasoline. Read, associated with Universal Oil Products Co., Chicago, presented this paper (here abridged) at the National Petroleum Association meeting, Cleveland, April 17-18.

THE following processes or methods of improving octane rating may be classified as stopgap measures in many cases.

1. Undercutting gasoline.
2. Selective fractionation of gasoline.
3. Increased polymerization of gases.
4. Isoforming.
5. Reforming.

Other processes, such as Unisol mercaptan extraction or Gray catalytic desulfurization, might also be considered as stopgap measures when high-sulfur gasolines are produced. However, the improvement in octane rating and lead susceptibility of gasoline by the removal of sulfur compounds is a separate subject and is omitted from these discussions.

This paper is intended to discuss the application of the above methods or processes to the refining of low-sulfur Mid-Continent crude and to compare the economics of various combinations of the processes with fluid catalytic cracking.

Basis for Economic Studies

In order to illustrate the various factors involved in comparing the economics of the so-called stopgap processes with fluid catalytic cracking, it is necessary to consider the over-all refinery operations in each case. This results from the fact that each process added to a given refinery usually has some effect on the operation of one or more of the other processes.

For the purposes of these studies it was assumed that the present operation (Scheme I) of the refinery consists of processing 7,000 bbl. per stream day of 38° A.P.I. gravity Mid-Continent crude in atmospheric distillation, two-coil thermal cracking, catalytic polymerization and treating equipment as shown in Fig. 1. It is also assumed that it is possible for the refiner to obtain 500 bbl. per stream day of outside casing-head gasoline at a price which makes the handling of this material a profitable operation. Even with this quantity of 26-lb. casing head available it is not possible to polymerize all of the propylene and butylenes available from the cracking unit in this case without encountering a deficiency of C_4 hydrocarbons for pressuring the total gasoline to 10 lb. R.v.p. Accordingly, only 105 bbl. per stream day of debutanized polymer are produced in Scheme I. The total polymer produced is utilized in the 1,000 bbl. per stream day premium gasoline blend which requires 2.0 cc. TEL per gallon to reach 80 octane number as indicated in Fig. 1. The remaining gasoline components are blended to produce 75-octane-number housebrand gasoline requiring 2.5 cc. TEL per gallon in this assumed blending procedure.

In Scheme II an isoforming unit is

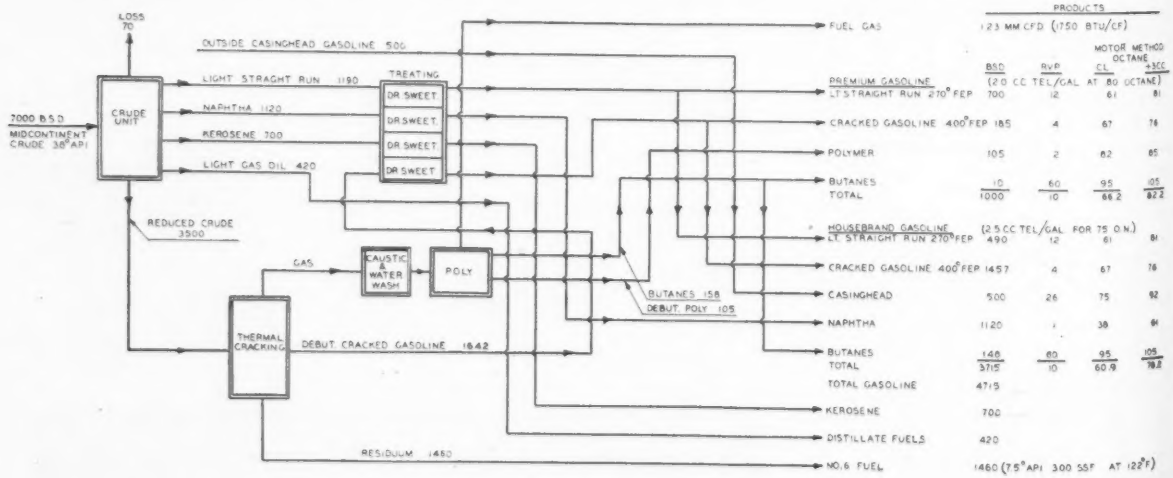
LOSS 70
OUTSIDE CASINGHEAD GASOLINE 500
LIGHT STRAIGHT RUN 1190
NAPHTHA 1120
KEROSENE 700
LIGHT GAS OIL 420
TREATING
DR. SWEET.
DR. SWEET.
DR. SWEET.
DR. SWEET.
7000 B.S.D. MIDCONTINENT CRUDE 38° API
CRUDE UNIT
REDUCED CRUDE 3500
GAS
CAUSTIC & WATER WASH
POLY
BUTANES 158
DEBUT. POLY 105
THERMAL CRACKING
DEBUT. CRACKED GASOLINE 1842
RESIDUUM 1460
PRODUCTS
FUEL GAS 123 MM CFD (1750 BTU/CF)
BSD RVP MOTOR METHOD OCTANE CL +3cc
PREMIUM GASOLINE (2.0 CC TEL/GAL AT 80 OCTANE)
LT. STRAIGHT RUN 270° FEP 700 12 61 81
CRACKED GASOLINE 400° FEP 185 4 67 76
POLYMER 105 2 82 85
BUTANES 10 60 95 105
TOTAL 1000 10 86.2 82.2
HOUSEBRAND GASOLINE (2.5 CC TEL/GAL FOR 75 O.N.)
LT. STRAIGHT RUN 270° FEP 490 12 61 81
CRACKED GASOLINE 400° FEP 1457 4 67 76
CASINGHEAD 500 26 75 92
NAPHTHA 1120 1 38 61
BUTANES 146 60 95 105
TOTAL 3715 10 60.9 78.2
TOTAL GASOLINE 4715
KEROSENE 700
DISTILLATE FUELS 420
NO. 6 FUEL 1460 (7.5° API 300 SSF AT 122° F)

Fig. 1—Present operations, Scheme I

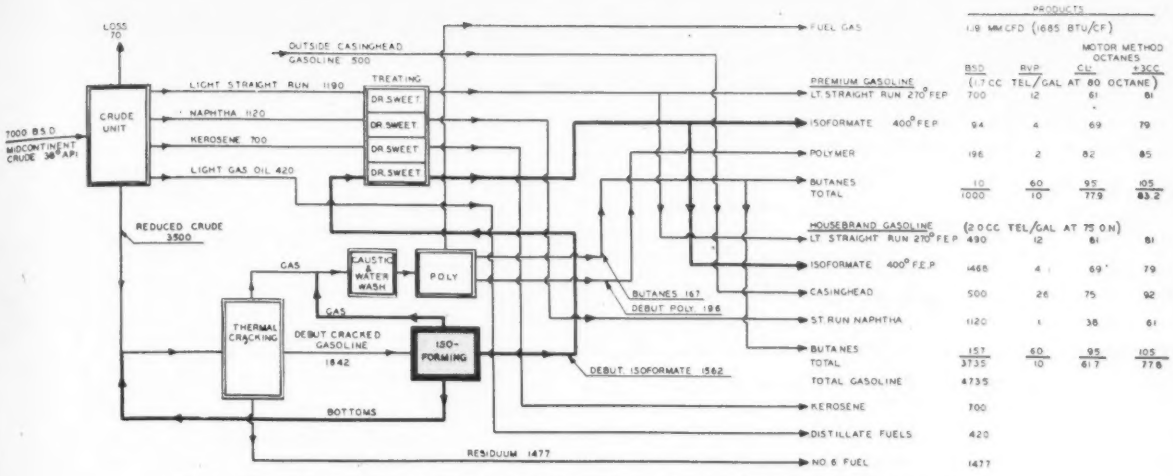

Fig. 2—Present operation with addition of isoforming and increased polymerization, Scheme II

added to the present operations to process 1,642 bbl. per stream day of debutanized thermally cracked gasoline, as indicated by the heavy lines in Fig. 2. Inasmuch as a small production of butanes accompanies the slight loss of gasoline hydrocarbons in the isoforming operation, it is possible to polymerize all of the recoverable propylenes and butylenes in this case without encountering a deficiency of butane for vapor pressure. Accordingly, an expansion of the polymerization unit to permit the production of 196 bbl. per stream day of debutanized polymer is incorporated in Scheme II. As shown in Fig. 2, the major effect of adding isoforming and increased polymerization facilities is to reduce the tetraethyl lead requirement to 1.7 cc. per gallon in the 80 premium blend and to 2.0 cc. per gallon in the 75 housebrand blend with a slight gain in over-all gasoline yield. There was a small increase in heavy-fuel-oil production and a decrease in fuel gas yield.

While the quality of the gasoline produced in this scheme is better than in Scheme I, it is possible to manufacture the 85 premium and 80 housebrand grades of gasoline only when a large quantity of the low octane straightrun naphtha is diverted to third-grade gasoline, tractor distillate, or solvents. The rate of production and lead requirements for the gasoline blends at the 85-80 octane level in Scheme II are estimated as follows:

	Bbl. per stream day	TEL cc./gal.
85-octane premium	415	2.9
80-octane housebrand	3,320	2.3
Third grade (65 octane)	1,000	2.5

Since the average refiner does not normally market products in these proportions, the modifications incorporated in Scheme II must be classified as stopgap measures.

Catalytic reforming the heavy naphtha in a separate unit would be one approach to the problem, but the yield-octane relationship obtained in catalytic reforming low-sulfur stocks does not appear to be sufficiently better than mild thermal reforming at present to justify the additional cost of the operation, especially when existing reforming capacity can be utilized. For the purposes of these studies, therefore, Scheme III has been based on the addition of mild thermal reforming of the total 1,120 bbl. per stream day of heavy naphtha followed by isoforming the combined 2,570 bbl. per stream day of thermally reformed and cracked gasoline as shown in Fig. 3. In this case, the increased butane production and the decrease in gasoline production resulting from the reforming and isoforming operations make it necessary to reduce the quantity of casing-head gasoline brought in from the outside in order to balance the gasoline Reid vapor pressure at 10 lb. As in Scheme II, the polymerization unit is modified to permit the conversion of all of the recoverable propylenes and butylenes to polymer gasoline in this scheme.

The additions made in Scheme III result in a marked reduction in the tetraethyl lead requirement for 80-octane premium and 75-octane housebrand gasolines, but a considerable

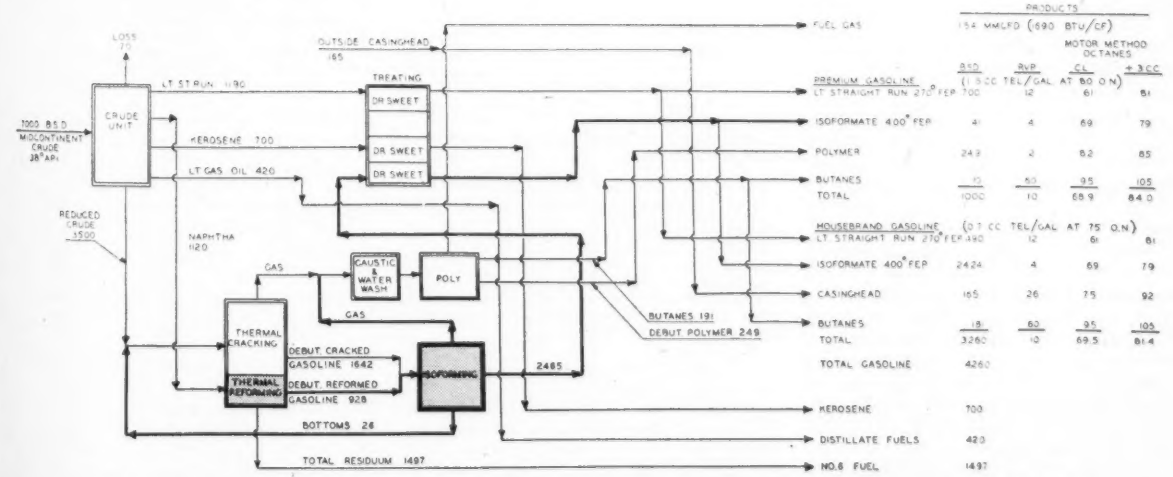

Fig. 3—Present operations with addition of thermal reforming, isoforming, and increased polymerization, Scheme III

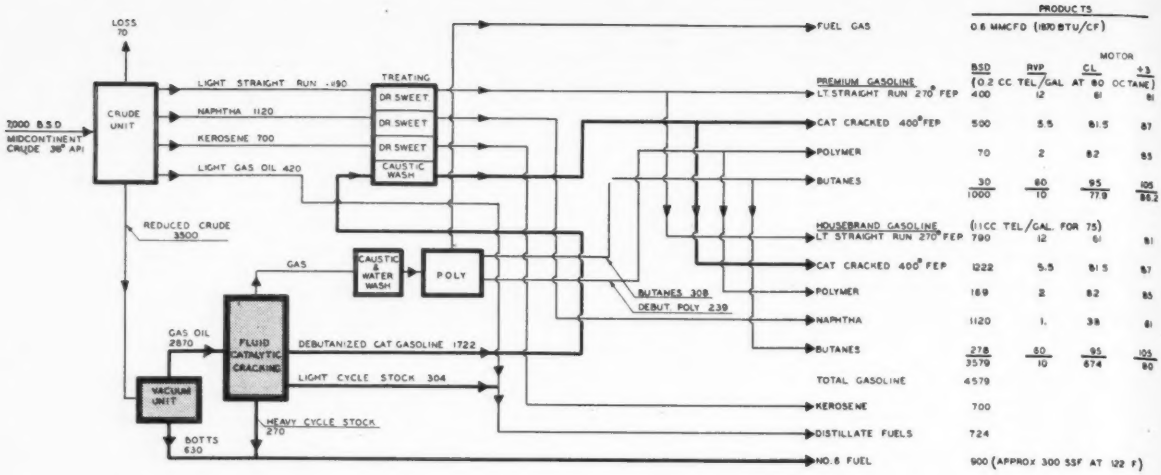

Fig. 4—Present operations with vacuum distillation and catalytic cracking replacing thermal cracking, Scheme IV

amount of gasoline is lost both through conversion to hydrocarbons boiling out of the gasoline range, and because of the smaller amount of casing head which can be utilized in the blends. Fig. 3 shows that the concentration of tetraethyl lead in the premium and housebrand gasolines is estimated at 1.5 cc. per gallon and 0.7 cc. per gallon, respectively, while maintaining the same production of premium gasoline as in the other schemes.

The improvement in gasoline quality realized by the addition of both the isoforming and the thermal reforming processes will permit the production of the 85-80 octane grades of gasoline at the following rates and lead concentrations:

	Bbl. per stream day	TEL cc./gal.
85-octane premium	530	2.3
80-octane housebrand	3,730	2.4

While this represents only slightly more than 12 per cent premium-gasoline production, it is interesting to note that it is not necessary to market third-grade gasoline in this case. Unless the lead concentrations are prohibitive, this operation might be considered acceptable by some refiners from the standpoint of improving gasoline quality alone.

In Scheme IV fluid catalytic cracking has been substituted for thermal cracking as shown by the heavy lines in Fig. 4. Since the entire reduced crude cannot normally be charged directly to the catalytic cracking unit, because of the presence of salts which poison the catalyst and high-boiling fractions which increase the coke yield, the feed for catalytic cracking is prepared by vacuum flashing the reduced crude in this scheme. The bottoms from the vacuum unit can, of course, be sold as asphalt or blended with the heavy cycle stock from the catalytic cracking unit for sale as bunker fuel. The latter procedure has been followed in this case since it represents the operation the average Mid-Continent refiner would probably follow. However, a more profitable operation would normally result from the sale of the residual oil as asphalt if a market were available, and this is a factor which must be taken into consideration in determining its most economic disposal. The light catalytic cycle stock which has a boiling range of 400°-600° F. is blended with the gas oil from the crude unit for sale as distillate fuel.

The high yield of butanes in the catalytic cracking scheme eliminates the use of outside casing-head gasoline in the over-all refinery blends, which are again based on 10-lb. R.v.p. It will be noted in comparing this scheme with the present operations in Scheme I that even though the outside casing head has been reduced by 500 bbl. per stream day, the over-all gasoline production is only 136 bbl. per stream day less than that shown in the first scheme. This results from the fact that (1) the production of catalytic gasoline is higher than the production of thermal gasoline and (2) the yield of polymer is greater in Scheme IV than in the first scheme.

Although it is possible to produce considerably more 80-octane premium gasoline than the 1,000 bbl. per stream day shown in Fig. 4, the blends have been calculated on this basis for comparison with the preceding flow diagrams. The premium and housebrand grades thus contain only 0.2 cc. per gallon and 1.1 cc. per gallon of tetraethyl lead in this case. It is interesting to note that it is possible to maintain the same production of premium gasoline even at the 85-80 octane levels without exceeding the maximum

TABLE 1—ECONOMIC COMPARISON OF PROCESSING SCHEMES: 80-OCTANE PREMIUM AND 75-OCTANE HOUSEBRAND

	Scheme I	Scheme II	Scheme III	Scheme IV
	Present operations, $/S.D.	With added isoforming and increased polymerization, $/S.D.	With added thermal reforming, isoforming, increased polymerization, $/S.D.	Replace thermal cracking with catalytic cracking, increased polymerization $/S.D.
Costs:				
Crude @ $1.91/bbl.	13,370	13,370	13,370	13,370
Casing head @ 7c/gal. delivered	1,470	1,470	486	.....
Direct refinery costs	1,665	1,880	2,167	2,057
Tetraethyl lead @ 0.2c/cc.	947	770	318	347
Indirect costs	1,200	1,314	1,382	1,564
Total costs (excluding income tax and interest)	18,642	18,804	17,723	17,338
Returns:				
Premium gasoline @ 9c/gal.	3,780	3,780	3,780	3,780
Housebrand gasoline @ 8c/gal.	12,482	12,550	10,954	12,025
Kerosene @ 6.5c/gal.	1,911	1,911	1,911	1,911
Distillate fuels @ 6.25c/gal.	1,105	1,105	1,105	1,904
No. 6 fuel @ $1.57/bbl.	2,292	2,319	2,350	1,413
Fuel gas @ 15c/M.M. B.t.u.	322	300	390	161
Total returns	21,892	21,965	20,490	21,194
Net earnings after deducting depreciation	3,250	3,161	2,767	3,856
Net earnings before deducting depreciation on new equipment	3,250	3,275	2,949	4,220
Additional investment, including changes to polymerization unit	.....	$375,000	$600,000	$1,200,000
Payout time on new equipment, yrs.	....	.....	.....	3.8

TABLE 2—ECONOMIC COMPARISON OF PROCESSING SCHEMES: 83-OCTANE PREMIUM AND 78-OCTANE HOUSEBRAND

	Scheme I	Scheme II	Scheme III	Scheme IV
	Present operations, $/S.D.	With added isoforming and increased polymerization, $/S.D.	With added thermal reforming, isoforming, increased polymerization, $/S.D.	Replace thermal cracking with catalytic cracking, increased polymerization $/S.D.
Costs:				
Crude @ $1.91/bbl.	13,370	13,370	13,370	13,370
Casing head @ 7c/gal. delivered	1,470	1,470	486	.....
Direct refinery costs	1,655	1,880	2,167	2,057
Tetraethyl lead @ 0.2c/cc.	833	1,132	595	685
Indirect costs	1,200	1,314	1,382	1,564
Total costs (excluding income tax and interest)	18,528	19,166	18,000	17,676
Returns:				
Premium gasoline @ 9c/gal.	1,588	2,967	3,780	3,780
Housebrand gasoline @ 8c/gal.	10,406	13,272	10,954	12,025
Third grade gasoline 65 O.N. @ 7.5c/gal.	3,459	.....	.....	.....
Kerosene @ 6.5c/gal.	1,911	1,911	1,911	1,911
Distillate fuels @ 6.25c/gal.	1,105	1,105	1,105	1,904
No. 6 fuel @ $1.57/bbl.	2,292	2,319	2,350	1,413
Fuel gas @ 15c/M.M. B.t.u.	322	300	390	161
Total returns	21,083	21,874	20,490	21,194
Net earnings after deducting depreciation	2,555	2,708	2,490	3,518
Net earnings before deducting depreciation on new equipment	2,555	2,822	2,672	3,882
Additional investment, including changes to polymerization unit	.....	$375,000	$600,000	$1,200,000
Payout time on new equipment, yrs.	.....	4.8	15.6	2.8

TABLE 3—ECONOMIC COMPARISON OF PROCESSING SCHEMES: 85-OCTANE PREMIUM AND 80-OCTANE HOUSEBRAND

	Scheme II	Scheme III	Scheme IV
	With added isoforming and increased polymerization, $/S.D.	With added thermal reforming, isoforming, increased polymerization, $/S.D.	Replace thermal cracking with catalytic cracking, increased polymerization $/S.D.
Costs:			
Crude @ $1.91/bbl.	13,370	13,370	13,370
Casing head @ 7c/gal. delivered	1,470	486	.....
Direct refinery costs	1,880	2,167	2,057
Tetraethyl lead @ 0.2c/cc.	932	854	1,069
Indirect costs	1,314	1,382	1,564
Total costs (excluding income tax and interest)	18,966	18,259	18,060
Returns:			
Premium gasoline @ 9c/gal.	1,569	2,003	3,780
Housebrand gasoline @ 8c/gal.	11,155	12,533	12,025
Third grade gasoline 65 O.N. @ 7.5c/gal.	3,150	.....	.....
Kerosene @ 6.5c/gal.	1,911	1,911	1,911
Distillate fuels @ 6.25c/gal.	1,105	1,105	1,904
No. 6 fuel @ $1.57/bbl.	2,319	2,350	1,413
Fuel gas @ 15c/M.M. B.t.u.	300	390	161
Total returns	21,509	20,292	21,194
Net earnings after deducting depreciation	2,543	2,033	3,134
Net earnings before deducting depreciation on new equipment	2,657	2,215	3,498
Additional investment, including changes to polymerization unit	$375,000	$600,000	$1,200,000

TEL specification of 3.0 cc. per gallon in either gasoline blend. If the tetraethyl lead concentration is limited to less than 3.0 cc. per gallon, either the percentage of 85-octane premium gasoline would be reduced or it would be necessary to reform some of the heavy straightrun naphtha in this scheme.

The estimated installation cost in Scheme IV includes all of the equipment in the process area which is required to produce debutanized gasoline and a liquid C_3-C_4 fraction for feed to the polymerization unit. The operating cost amounts to approximately 35 cents per barrel of feed in this example. This cost would, of course, be reduced if it were desired to operate the catalytic cracking unit at lower conversion to produce less gasoline and more distillate fuels. Note that the synthetic cracking catalyst is used in this case rather than the less-expensive natural catalyst in order to obtain a high-octane-number gasoline which will carry all of the low-octane-number straightrun naphtha in the final blends, even at the 85-80 octane level.

Economic Comparisons

Since the economics of the various processes added for octane number improvement will vary at different octane levels, studies were made of the earnings of the refinery using these various processes at three octane levels—the present level considered to be 80 premium and 75 housebrand, together with both 83-78 and 85-80 grades. It was attempted in all instances to produce 20-25 per cent premium gasoline although in certain cases, it was necessary to market part of the gasoline as third grade because of over-all octane deficiencies. The results of the studies at each of the three octane levels are presented in Tables 1, 2, and 3.

The cost of raw materials and value of products used in these calculations were taken directly from the March 17, 1947, quotation of Platt's Oilgram for the midwestern group. The same utility and labor rates were used in calculating the operating costs for all processes considered in these comparisons.

Considering first the comparison at the 80-75 octane level as shown in Table 1, it is noted that only Scheme IV earns more money after deducting depreciation for new equipment than the present operations in Scheme I. The catalytic cracking operation would have the most utility in this case, primarily because of the increased gasoline yield, which more than offsets the loss of casing-head gasoline in this scheme as previously explained. Another factor which makes the catalytic cracking scheme more favorable is the fact that it is possible to upgrade very heavy fuel oil into higher priced distillate fuels with fluid catalytic cracking.

The installation costs in each of these schemes are estimated on the basis of utilizing existing equipment as far as possible in the average refinery. For example, in Schemes II and III the capacity of the polymerization facilities might be increased by the conversion of an existing polymerization unit to permit processing the total cracking unit gases rather than only the stabilizer gas. In some cases sufficient equipment might be on hand to make a marked reduction in the installation cost of the isoforming unit, but it has been assumed that no existing equipment is available for the isoforming operation in this case. Consequently, the entire cost of a new isoforming unit has been included in these calculations. Similarly, while a refiner may have some reforming capacity in an existing cracking coil it has been assumed in Scheme III that only a part of the heavy naphtha can be reformed in this manner in the average case and an allowance for some new thermal reforming capacity is included in the total installation cost.

In Scheme IV the existing polymerization unit might be expanded by the addition of a reactor section ahead of the catalyst chambers to permit the processing of a high-olefin-content liquid C_3-C_4 fraction from the catalytic cracking unit. In addition, experience has shown that it is pos-

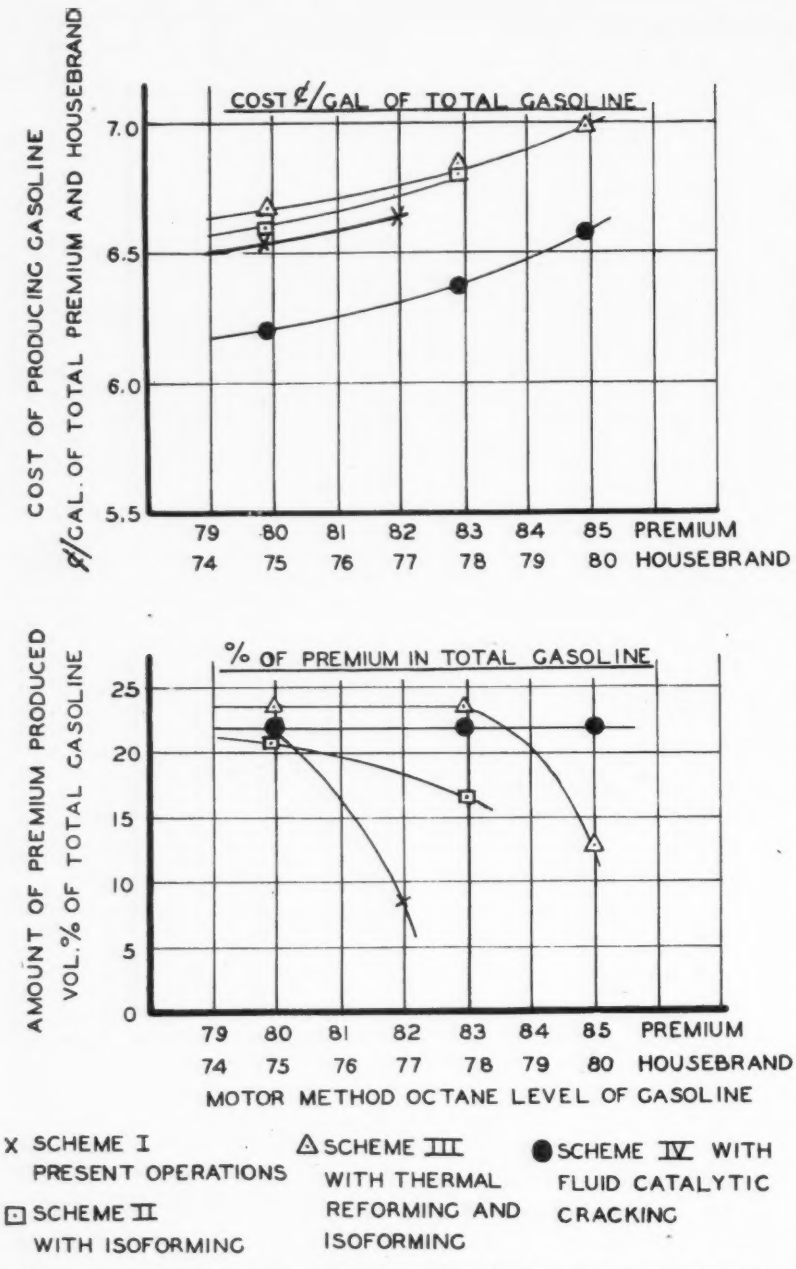
COST ¢/GAL OF TOTAL GASOLINE
COST OF PRODUCING GASOLINE ¢/GAL. OF TOTAL PREMIUM AND HOUSEBRAND
7.0
6.5
6.0
5.5
79 80 81 82 83 84 85 PREMIUM
74 75 76 77 78 79 80 HOUSEBRAND
% OF PREMIUM IN TOTAL GASOLINE
AMOUNT OF PREMIUM PRODUCED VOL. % OF TOTAL GASOLINE
25
20
15
10
5
0
79 80 81 82 83 84 85 PREMIUM
74 75 76 77 78 79 80 HOUSEBRAND
MOTOR METHOD OCTANE LEVEL OF GASOLINE
X SCHEME I PRESENT OPERATIONS
△ SCHEME III WITH THERMAL REFORMING AND ISOFORMING
● SCHEME IV WITH FLUID CATALYTIC CRACKING
⊡ SCHEME II WITH ISOFORMING

Fig. 5—Cost of producing gasoline at various octane levels, and proportion of premium gasoline (only two grades produced)

sible to utilize a number of parts of the thermal cracking unit in converting to catalytic cracking. For example, the cracking-unit heater and reactor or flash chamber might be used for vacuum flashing the reduced crude to prepare the catalytic cracking unit feed stock. The control house and instruments, fractionator, stabilizer and some parts of the gas recovery section of the thermal cracking unit might also be used in certain cases in the new operation. These factors have been considered in estimating the total additional investment required in Scheme IV.

The additional earnings of the refinery with catalytic cracking in Scheme IV will permit paying out the new equipment in 3.8 years, while the earnings at the 80-75 octane level in Schemes II and III are such that essentially no payout is indicated at this octane level. It is apparent that in each of these schemes it is possible to increase the refinery earnings by producing more premium gasoline than in the present operations. However, the quantity of premium gasoline has been held constant in all cases for purposes of comparison.

The results of these studies are also compared on the basis of the cost of producing gasoline in each scheme on Fig. 5. In calculating the gasoline cost, the total direct and indirect costs for each operation, less the value of products other than gasoline, were divided by the total gallons of gasoline produced. The resulting costs were then plotted against the octane level of the premium and housebrand gasoline. It should be noted that the production of only the premium and housebrand grades of gasoline in the proportions shown at the bottom of Fig. 5 are considered in these calculations. Those refining schemes which require the production of third-grade gasoline in order to meet a given octane specification were recalculated at the next lower octane level to avoid third-grade-gasoline production.

On this basis it is interesting to note that the cost of producing a gallon of gasoline at a given octane level is greater in Schemes II and III than in the present operation, while the operation with fluid catalytic cracking results in a 0.3-0.4 cent per gallon lower cost than that shown in the other schemes. It will be apparent that a part of this difference results from the fact that the price assumed for the casing-head gasoline at the refinery (7 cents per gallon) is slightly more than the cost of making gasoline from crude. This results in a maximum increase of about 0.1 cent per gallon in the cost of the total gasoline produced in the schemes in which casing-head is utilized. It is not unreasonable to expect the manufacturing cost to be related as shown on Fig. 5, however, when it is considered that the isoforming and thermal reforming processes added improve the octane rating at the expense of gasoline production in Schemes II and III, while catalytic cracking upgrades more heavy fuel oil into high-octane-number gasoline and distillate fuels. It might be mentioned that it is possible in some cases to show a reduction instead of an increase in cost per gallon of gasoline produced by installing isoforming or reforming. This can be brought about, for example, when low octane naphtha is being produced as tractor distillate or kerosene by undercutting, and the installation of isoforming or reforming permits this material to be upgraded to increase the volume of gasoline produced. It should be noted that each of these costs can be raised or lowered by varying the percentage of premium gasoline produced, but in general, a greater proportion of premium can be produced at a given octane level in the catalytic cracking scheme than in the other cases.

Summary

For the processing of low-sulfur crudes under the conditions of the

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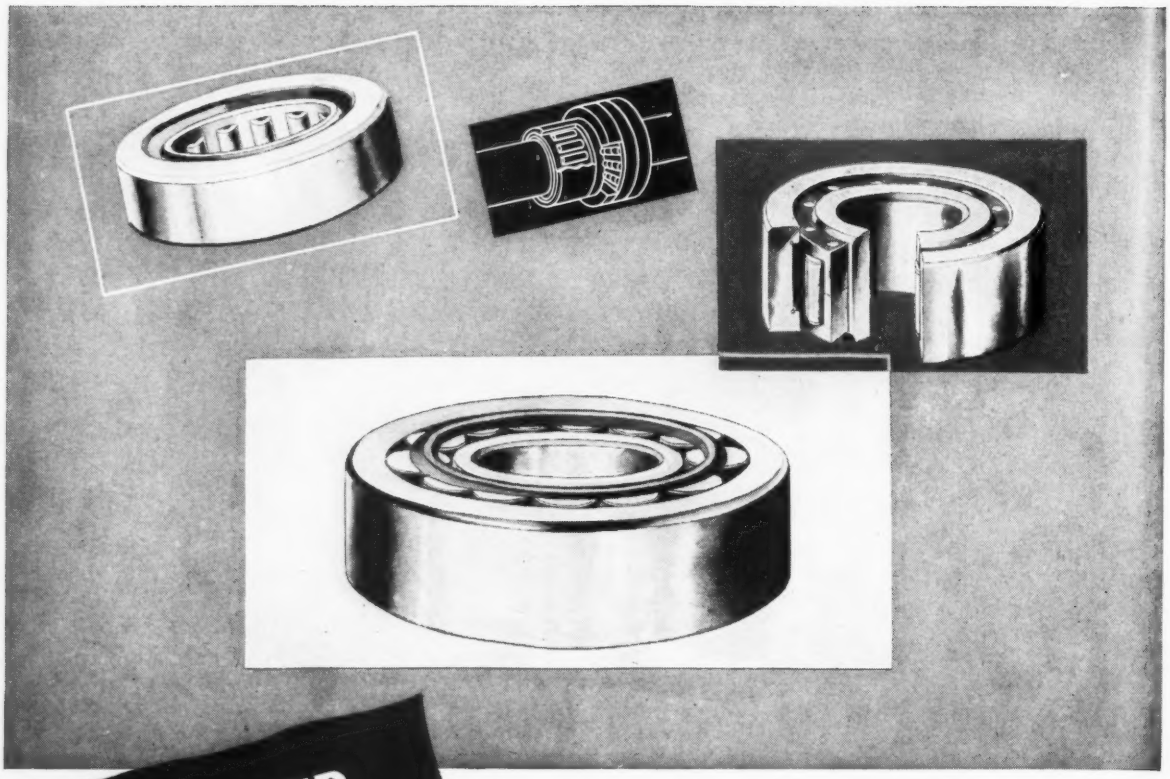

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TABLE 4—ADVANTAGES AND DISADVANTAGES OF THE VARIOUS PROCESSING SCHEMES

Scheme	Advantages	Disadvantages
II—Isoforming	1. Lowest installation cost 2. Offers a means of upgrading octane level at such low loss of gasoline yield that the loss can be offset by increased polymerization in this scheme 3. The isoforming process requires only low pressure conventional equipment which may, in some cases be on hand	1. Increases cost per gallon of gasoline produced 2. If catalytic cracking eventually replaces thermal cracking, the isoforming operation would not be needed, although it could be converted to cat. reforming 3. Cannot make 80-85 octane gasoline unless a large amount of third grade gasoline is produced in this scheme
III—Isoforming and thermal reforming	1. Can make 85-80 grade without producing third grade gasoline	1. Highest cost per gallon of gasoline produced 2. Installation cost approaches that of the catalytic cracking scheme
IV—Fluid catalytic cracking	1. Can make 85-80 grade without producing third grade gasoline 2. Lowest cost per gallon of gasoline at all octane levels studied 3. Permits increased production of distillate fuels from heavy gas oil 4. Improves research octane number of gasoline 5. Reduces production of bunker fuels	1. Highest installation cost

specific examples studied in this paper, the advantages and disadvantages of the various processing schemes in their relation to each other might be summarized as shown in Table 4.

All of the conclusions set forth above, of course, do not apply to all refinery situations. For example, in the event that a refiner has available a light straightrun gasoline which approaches 85 octane number with 3.0 cc. TEL per gallon and existing equipment is available, the isoforming operation will be much more attractive than the example illustrated in Scheme II. Similarly, if the heavy straightrun naphtha is normally sold as solvents or tractor distillate, the case for isoforming is much improved because the amount of gasoline upgrading required for the 85-80 octane level is reduced.

Although a refiner may be in a position to choose isoforming or reforming in preference to catalytic cracking by virtue of the reasons mentioned above, it would seem from this study that fluid catalytic cracking presents certain advantages over these operations which cannot be entirely ignored. The ability of the fluid catalytic cracking process to handle a wide variety of charge stocks ranging from kerosene through heavy gas oils and some topped crudes at operating temperatures from 800° to 1,000° F. is an advantage which is difficult to measure in general economic studies. The ease of operating a fluid catalytic cracking unit on stocks as low in A.P.I. gravity as 20-25 and at high reactor temperature to produce both a gasoline of high research octane rating and low-boiling distillate fuels is a feature which is assuming increasing importance.

Accident-Frequency Rates

by Henry W. Boggess*

A SUCCESSFUL program of accident prevention necessarily must include a comprehensive system of records, else analyses of accident causes and consequent remedial activities cannot be done intelligently.

In addition to accident reports, from which analyses are made, it is also important to measure whether or not applied controls are fruitful. The standard method of measuring progress in accident prevention work is known as the "frequency rate." A frequency rate is the expression in terms of a standard measure of the number of injuries occurring within an industrial unit over a given period of time. It is one of two rates which are used to measure the extent of the industrial-injury problem.

The effectiveness of any continuing activity can be judged only by the use of a method of measuring results—a basis of comparison. For example, it is customary to express profit in terms of a percentage of plant investment. This is true because, alone, the number of dollars earned is no measure of the profitability of any business. Five thousand dollars may be a good return on an investment of $100,000, but is a poor return on $500,000. By expressing profit as a percentage of investment, a standard is used by which the return on a business may be compared for any one period of time with any other period of time.

By translating the number of disabling injuries due to on-the-job accidents into frequency rates, the same purpose is served as when profits are expressed as a percentage of plant investment.

To compute accident-frequency rates, three things are necessary: (1) actual number of disabling injuries; (2) a standard of measurement; (3) actual man hours of exposure.

1. A disabling injury should be understood as any injury arising out of and in the course of employment which causes loss of time beyond the shift or tour of work during which the injury occurs. (An employe shall be considered disabled if he cannot return to his regularly assigned work the day following the injury.)

2. The generally accepted standard of measurement recommended by American Standards Association, National Safety Council, American Petroleum Institute, and other national bodies, and exclusively used by practically all American industries, is 1,000,000 man hours of work.

3. The third component of the frequency rate is the actual number of man hours worked by all employes during the period for which the rate is computed, such as a given month or a calendar year. This is the time during which employes are exposed to accident hazards.

A frequency rate is determined by multiplying the number of disabling (lost-time, as described in No. 1 above) injuries by 1,000,000 (the standard of measurement) and then dividing the product by the total number of man hours worked during the period. Formula:

$$\text{Accident frequency} = \frac{\text{Number disabling injuries} \times 1{,}000{,}000}{\text{Man hours of exposure}}$$

The frequency rate for the entire petroleum industry for 1945, as reported by National Safety Council, was 14.38.

*Superintendent, Employment-Insurance-Safety, Sinclair Prairie Oil Co.

Application to Cycling of Gas Injection Below Normal Gas-Water Contact

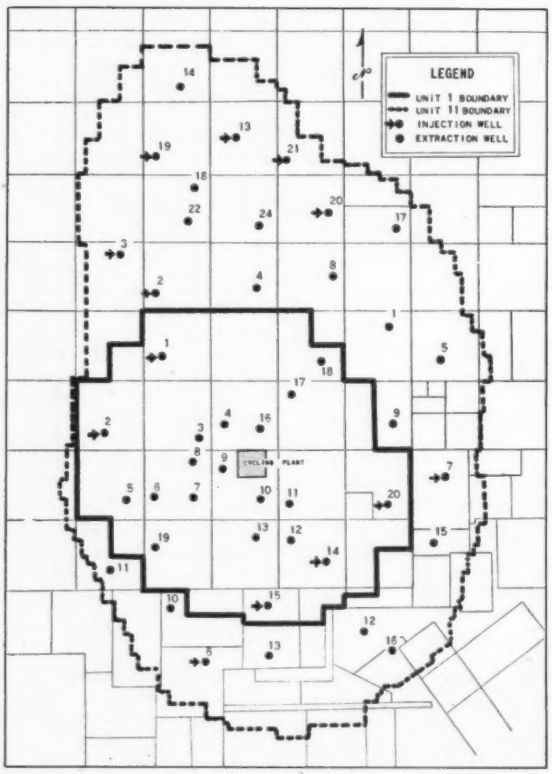
by Harold L. Hensley

Injection of gas through edge wells completed below the normal gas-water contact is being applied successfully in several cycling projects. Here is presented a summary of experiences from this type of completion together with discussion of case histories. The paper was given at the twenty-sixth annual convention of the Natural Gasoline Association of America held at Dallas, April 23-25. In this printing a portion of the material dealing with experimental measurements of pressure and temperature in injection well II-2 are omitted. The author is with Humble Oil & Refining Co.

GAS-INJECTION into a salt-water sand first was accomplished satisfactorily early in 1944. It is possible that previous such attempts had been made, but if such were the case, the results were not known generally. The success of this operation established the practicability of the method under certain reservoir conditions. The permeability of the sand in this particular case was in the magnitude of 4,000 to 5,000 md.

Shortly thereafter, in July 1944, a similar operation was undertaken in the Katy Gas field, located approximately 30 miles west of Houston. The subject reservoir in this structure was indicated to possess an average permeability of 300 to 400 md., a permeability of roughly one-tenth of that exhibited by the sand involved in the first successful application. Despite the relatively tighter sand, however, the Katy operation was deemed successful and practicable.

The two initial successful attempts at gas-injection into a salt-water sand nurtured, practically speaking, by necessity, and under such circumstances were undertaken as experimental projects and attended by considerable skepticism. The apparent early success of these applications, substantiated by later developments, led subsequently to the drilling and recompletion of several additional wells in the two fields mentioned for the specific purpose of injecting gas into sands below the gas-water contact. In the field first cited there are at present seven wells completed for this type of gas injection; in Katy field, a total of eight wells of this type are in proven service. One of these wells is located approximately 1,000 ft. in a lateral direction from



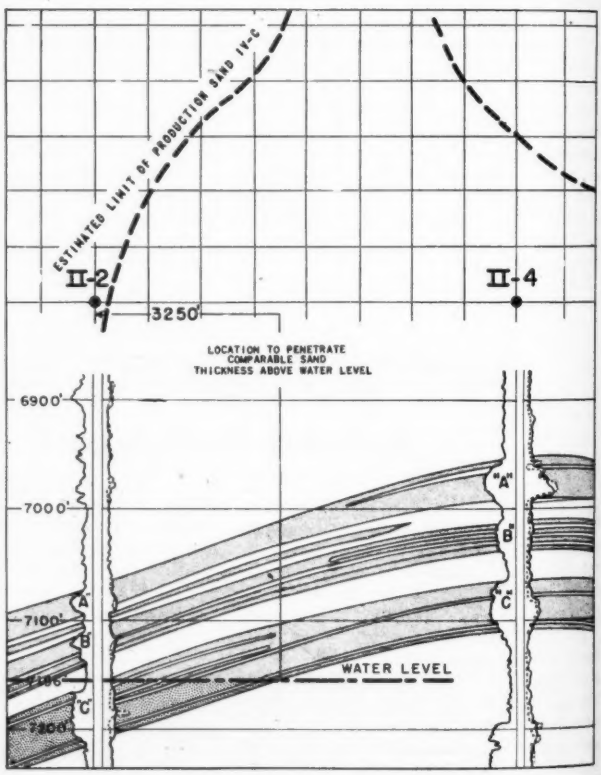


Fig. 1—(Left) Katy gas field, Waller County, Texas, as originally defined and ultimately proven. These two limits show the considerable expansion which has occurred. Maximum dimensions are 10 miles north-south, 6 miles east-west. Fig. 2—(Right) Gas injection below gas-water contact

the gas-water contact, and the top of the sand is 26 ft. below the water-level.

This method of injection has not been restricted entirely to the two fields mentioned, although in these fields the method does have its greatest application. In at least three other smaller gas-condensate pools in South Texas, one input well in each instance has been completed with the exposed sand below, or partially below, the normal contact; and in a fourth field in the same general area, a similar completion is contemplated.

It is proposed in the ensuing discussion, to present several case histories reflecting the experience which has accrued from the operation of certain gas-injection wells completed in salt-water sands.

Application in the Katy gas field (Field "A") general.—Katy gas field, which will be considered as representing Field "A," is a unitized project under the operation of Humble Oil & Refining Co., and has been an active cycling project since January 1, 1943. The structure is comprised of six major sand zones, and encompasses an area of approximately 30,000 acres. At the time that cycling operations were initiated, the field was defined to include only 11,285 acres, and it was not until July 1, 1944, that the proven productive area had been extended to its present boundaries. There are at present a total of 47 wells in service, 33 being utilized for extraction and 14 for injection. (See Fig. 1).

Practically all of the cycling to date has been restricted to one zone, which has been termed Sand IV. This sand zone is comprised of three apparently separate and delineated sand members, termed "A," "B," and "C." A common water level is accepted for these three stringers, but for the purpose of cycling it is necessary that they be constructed as separate reservoirs. Inasmuch as the earlier well completions, either for extraction or injection, had not been restricted, generally, to the individual sand members, it is evident that the mechanics of parallel cycling are in effect.

Initial consideration of below-water injection.—During the expansion of the field as a result of exploratory drilling, it was realized that to pursue effectively the parallel cycling of the three strata comprising Sand IV it was necessary to provide in each of these strata a capacity for injection which would approach the capacity for withdrawals. Since it is believed that the three members of Sand IV have a common gas-water contact, and with the structure being domal in shape, it follows that one or both of the lower members are below the water level at the field's edge. Thus, it seemed necessary, at first, that to provide additional well-capacity for injection would require the choice of one of these alternatives: first, to utilize the wells most suitably located and to recomplete in those sand members lying structurally above the gas-water contact; secondly, to drill additional wells located upstructure a sufficient distance to allow penetration of all three sand members, thereby exposing between the wells and the structure's edge a reservoir volume of considerable magnitude in which invasion would be questionable; or thirdly, to drill even a greater number of additional wells to be completed only in a single sand member, and to be located as closely as possible to the gas-water contact and yet be assured of sufficient sand penetration.

None of these alternatives was attractive, so the idea was advanced that if it were practicable and feasible to inject below the gas-water contact into a water sand in a well suitably located, a solution might be attained. It was theorized that the injected gas would displace the water in the immediate vicinity of the wellbore, and then move upstructure, displacing the wet-gas from the extreme edge toward the withdrawal areas.

Experimental application of gas-injection below normal gas-water contact.—The case at point at the time was Sand IV-C, which required a more effective spacing of the returned gas, and in which existed a deficiency in injection capacity. It was found that Well II-2 was ideally located, as related both to area and structure, for such an experiment, and that Sand IV-C in this well, which was entirely below water-level, was indicated to possess good development.

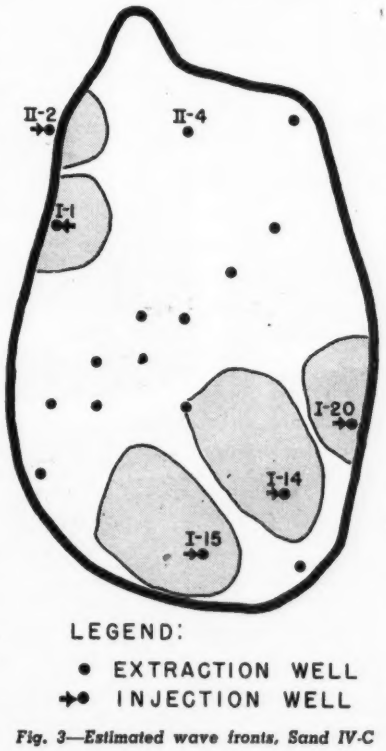


Fig. 3—Estimated wave fronts, Sand IV-C

Well II-2 had been used for injection in Sands IV-A and IV-B, so was reworked in order to expose to the wellbore Sand IV-C and to isolate, by means of a packer, this lower sand member from the upper two. To assure segregation of the upper members from Sand IV-C during the tests, the tubing-casing annulus was left mud-filled. A side-door choke was installed in the tubing string immediately above the packer to permit the unloading of the annulus at the conclusion of the tests and preparatory to the resumption of gas-injection into the annulus.

The subsequent tests proved conclusively that injection of gas into a water sand with physical characteristics and deposition qualities as existed in this well not only was practicable, but indications were that the pressure required at the sand face was not appreciably greater than would be required for a gas sand of similar characteristics.

Fig. 2 is a graphic concept of the basic consideration involved in the experimental injection project. The two partial electrologs shown are those for Wells II-2 and II-4, the latter being the most closely located extraction well in Sand IV-C. The three sand members, "A," "B," and "C," are obvious on the respective logs, and their delineation over the area of the structure separating the two wells is reflected by the cross-section. The intervals exposed to the respective wellbores are noted appropriately, and it is readily apparent that Sand IV-C in Well II-2 lies entirely below the accepted gas-water contact at 7,156 ft. subsea.

If Well II-2 had been drilled in a position to have penetrated the entire interval of Sand IV above the gas-water contact, it would have required moving the location upstructure approximately 3,250 ft. Such a location would render vulnerable to noninvasion a reservoir volume of considerable magnitude between the input well and the structure's edge. Furthermore, should the location inadvertently have been an insufficient distance upstructure to have penetrated the entire interval of Sand IV-C, it would have been possible, in view of the apparent continuity in this portion of the field of at least two shale streaks, to have left uncycled some lower portion of the sand.

Fig. 3 is a reproduction, in part, of a map of Sand IV-C resulting from a potentiometric model study for the purpose of predicting for a particular date the volume and configuration of the dry-gas "bubbles" emanating from the several input wells. It serves suitably to demonstrate the effectiveness of Well II-2 as an injection well in this sand. The desirable areal location of the well for input purposes

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7¼	1030	1375	1715	2060	2400
6¾	1190	1585	1980	2375	2775
6¼	1385	1850	2310	2775	3235

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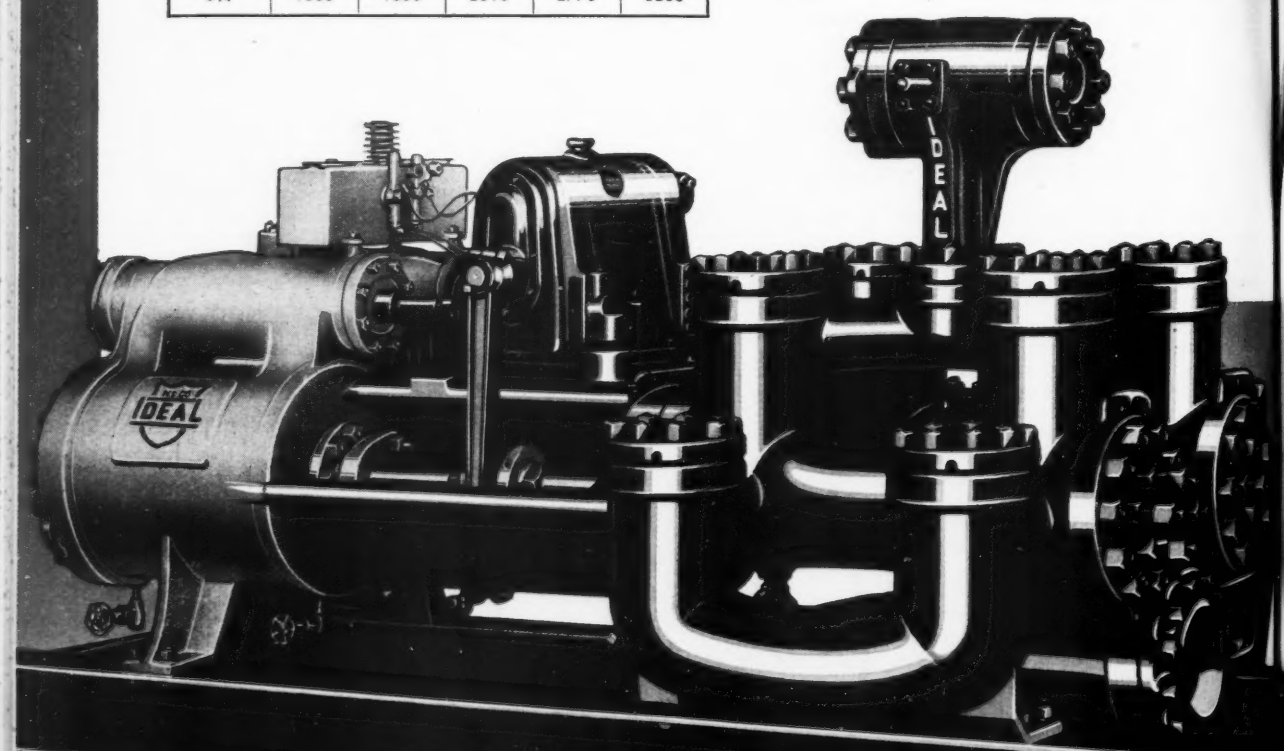
PISTON SIZE, INCHES	GALLONS PER STROKE	Speed, Strokes Per Minute				
		20	30	40	50	60
7¾	16.51	330	495	660	825	990
7¼	14.27	285	430	570	715	855
6¾	12.17	245	365	485	610	730
6¼	10.23	205	305	410	510	615



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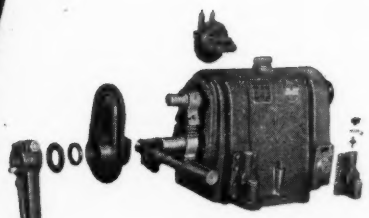

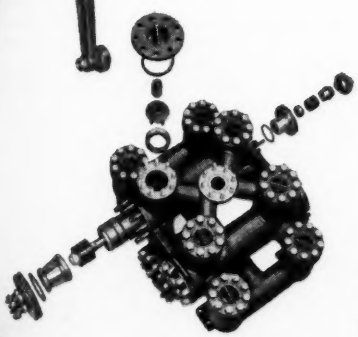

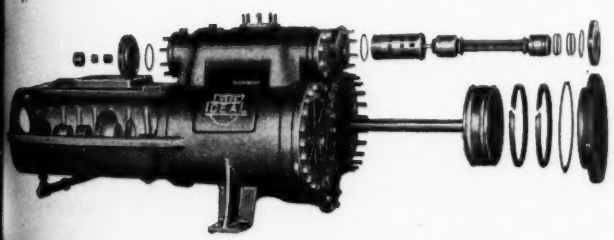

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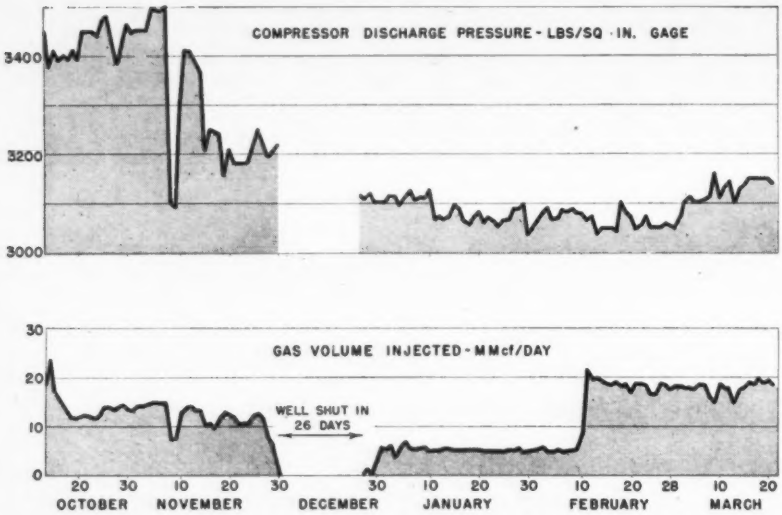


Fig. 4—Injection volume vs. plant discharge pressure, K.G.F.U. 11, well No. 19

is apparent; its use as such should improve the over-all ultimate invasion, and, in so doing, should assure adequate sweepage of a considerable portion of that area near the structure's edge.

Later application of below-water injection.—Based on the successful experience resulting from the experimental application of below-water injection in Well II-2, seven other wells subsequently were completed in this manner, with one or two sand members either partially or wholly below the normal gas-water contact. To date, the operating experience in every instance continues favorable.

Case History of Well II-19

As previously stated, it was theorized in regard to gas-injection below the gas-water contact, that the injected gas would displace the water in the immediate vicinity of the wellbore and then move upstructure, displacing the wet-gas from the extreme edge toward the withdrawal areas. A case history of one such well, II-19, in which the exposed sands are entirely below water level, substantiated this conception of the mechanics and illustrates the effects.

This well is completed in the "A" and "B" members of Sand IV, and is located in the north end field where the "A" member is comprised of two thin stringers. The top stringer of Sand IV-A is practically "pinched" out in this well, and the lower stringer was encountered slightly below the gas-water contact. A 4-to-6-ft. shale break separates this lower stringer of Sand IV-A and the top of Sand IV-B. In order to insure the opening to injection of all of the effective "A" member present, the entire interval from the top of the lower stringer in Sand IV-A to the base of Sand IV-B was exposed to the wellbore. Following completion and thorough cleaning by the back-flowing of salt water the sands were acid treated and again cleaned before placing the well in service.

A graph of the operating history of this well is presented in Fig. 4, and illustrates the behavior of these particular water sands to the injection of gas. During the first partial day of service, the rate of injection was 26 to 28 million cubic feet per day; but this rate gradually decreased over the next several days, and finally, on the twelfth day of service, appeared to approach stabilization at rates of 10 to 15 million cubic feet per day, depending upon the effective pressure at the well head. The well then was shut in, as the result of freezing difficulties in the line serving this well, for a period of 26 days.

On resumption of service, the effective well-head pressure was reduced appreciably due to certain changes at the plant, and the rate of injection through this well was correspondingly less. The rate continued at approximately 5 million cubic feet per day for 40 days, and then suddenly increased radically to a rate in excess of 20 million cubic feet per day. This represented an increase in input volume in the magnitude of 400 per cent, whereas the effective injection pressure actually was less. The rate of injection tended to decrease somewhat for several days, and then to become relatively uniform at 16 to 18 million cubic feet per day.

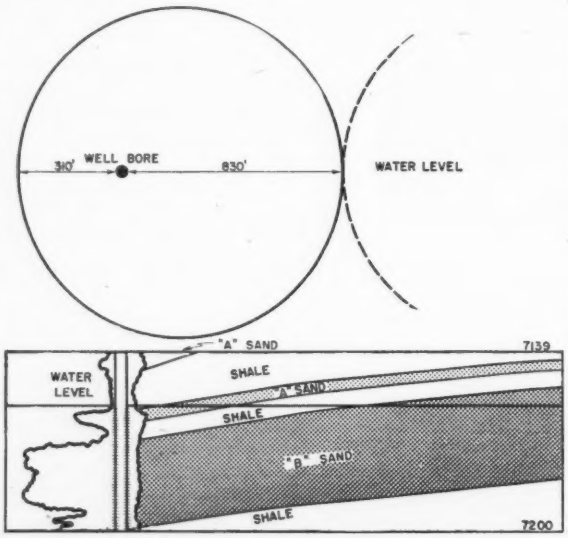


Fig. 5—Estimated pattern of flushed water sand, K.G.F.U., well No. 19

Theoretical concept of experience.—Just what may be the displacement pattern emanating into a water sand is a matter of conjecture. Certainly the pattern would be influenced to a great extent by relative location in regard to the water's edge and by the physical characteristics of the sand body.

At the time of the radical change in well characteristics, there had been injected into Well II-19, over a period of 92 days, a cumulative volume of approximately 823 million cubic feet of gas. On the basis of the data available, an attempt was made to justify the probability that the dry-gas wave from the wellbore finally had effected contact up-structure with the gas sand. Assuming a cylindrically-shaped flooding pattern and estimated net effective sand thickness of 32 ft., computations were made to determine the diametrical dimension of a cylinder whose volume would be commensurate with the volume of gas known to have entered the well. It developed that such a cylinder would have a diameter of 1,140 ft. The lateral distance from the wellbore to a point of contact with the gas sand was estimated to be 830 ft. Fig. 5 illustrates this concept of the problem.

The apparent effectiveness of below-water injection on the dry-gas flooding pattern in Sand IV-B is illustrated in Fig. 6, which is a representation of predicted dry-gas wave fronts in this sand on a particular date, as obtained by potentiometric analysis. Complete sweepage of the edge-areas is indicated by the "bubbles" emanating from Wells II-19, II-20, and II-21, all of which are completed partially or wholly below gas-water contact. The edge sweepage about Well II-6, which is not a below-water completion, appears fairly ef-

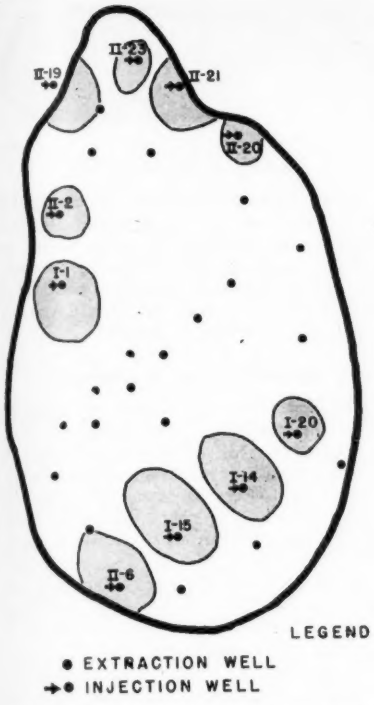


Fig. 6—Estimated wave fronts, sand IV-B

fective; however, the sand in this well is exposed to within 6 ft. of water.

Applications in Field "B." — The other of the two fields in which below-water injection of gas has had extensive and successful utilization will be designated Field "B." In this field, this method of injection is employed in the cycling of two of the more important reservoirs. A total of seven wells are so completed, and their adaptation to such use has resulted in an indicated appreciable improvement in ultimate invasion, and has precluded the necessity of drilling several additional wells. Several of these wells handle consistently 25 to 30 million cubic feet per day at normal injection pressures, and react in operation essentially the same as those wells completed conventionally a respectable distance above the water-level.

The completion equipment of the below-water injection wells is essentially the same as for the conventional-type of injection, except that gravel-packing is resorted to in the former type. Initial completions were not gravel-packed, and on production of salt-water to clean the perforations and the sand face of drilling mud and other foreign matter, the wellbore tended to "sand-up." It is reported that the use of the gravel-pack has corrected this condition, and has presented no operating difficulties, when on several occasions, it has become necessary to back-flow the wells.

The decision to attempt gas injection below water in this field was prompted by the knowledge that, in the reservoir in question, the section of sand from which most of the production would be obtained on the crest of the structure was below the gas-water contact at the proposed locations for injection wells. The formation was extremely lenticular, and even should the location of the injection wells have been moved upstructure sufficiently to have penetrated the upper portion of this sand section, it still appeared probable that the lower portion of the segment would have remained uncycled. Fig. 7 shows the productive outline of the subject reservoir, which shall be referred to as Sand "A," with the wells appropriately located and designated.

Application to Sand "A" of Field "B."—Cycling of Sand "A" was initiated with extraction from a line of wells through the center and crest of the structure, and with the injection wells located about the periphery.

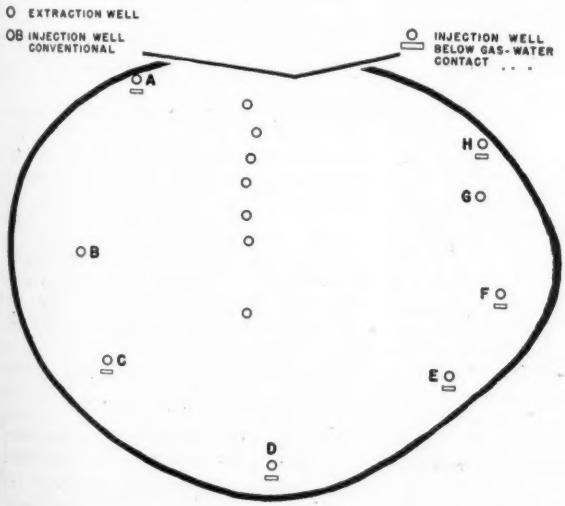
The well in which below-water injection was being attempted is designated on the exhibit as Well "A." This well had encountered the top of Sand "A" approximately 4 ft. above gas-water contact. Completion by gun perforation had been over an interval of 42 ft. from a point 16 ft. below contact to the base of the sand section (in a subsequent workover, this exposed interval was increased to 66 ft. to include the upper portion of the sand). The approximate lateral distance from the uppermost perforations to gas-water contact was 240 ft. and from the bottom perforations this distance was 890 ft. The other input wells, designated Wells "B" to "H," inclusive, were conventionally completed a reasonable distance above water.

Immediately on being placed in service, Well "A" took gas at the rate of 20 million cubic feet per day. Operating history over the following few months was somewhat erratic due to bridging difficulties in the well flow string, which led eventually to the installation of the gravel pack. The success of the experiment was established, nevertheless, and resulted in the recompletion, within a few months, of Wells "D," "E," and "H" to include in the exposed interval the section of sand lying below water, thereby probably increasing the effectiveness of the cycling pattern.

Subsequent developments, particularly the premature invasion by dry gas of the three southernmost extraction wells, presented evidence that Sand "A" probably should be considered as being comprised of three separate segments. If such structural conditions did exist, it probably would require that the three segments be considered as separate reservoirs and be cycled in parallel.

Potentiometric investigation, on the basis of this revised concept, indicated that invasion into the three wells mentioned had been through the upper segment only, and that the offending wave-fronts had emanated from Wells "C" and "F." Relying on this justification, these two input wells were reworked to eliminate injection into the upper segment and to

(Continued on page 92)



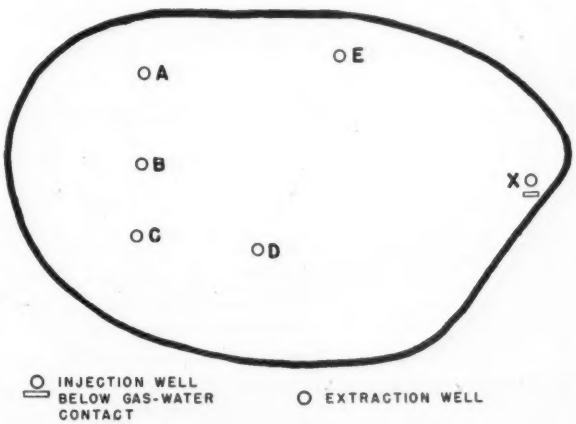


Fig. 7—(Left) Productive limits Sand "A," Field "B." Fig. 8—(Below) Productive limits Sand "B," Field "B"

An Elongated Reservoir

OIL PRODUCTION by water

PART 19 OF A SERIES

by Park J. Jones*

THE characteristics of an elongated reservoir are mapped out and the producing capacity by edge water at MER is given. The optimum location of producing and injection wells for the reservoir will be considered in the next and final article.

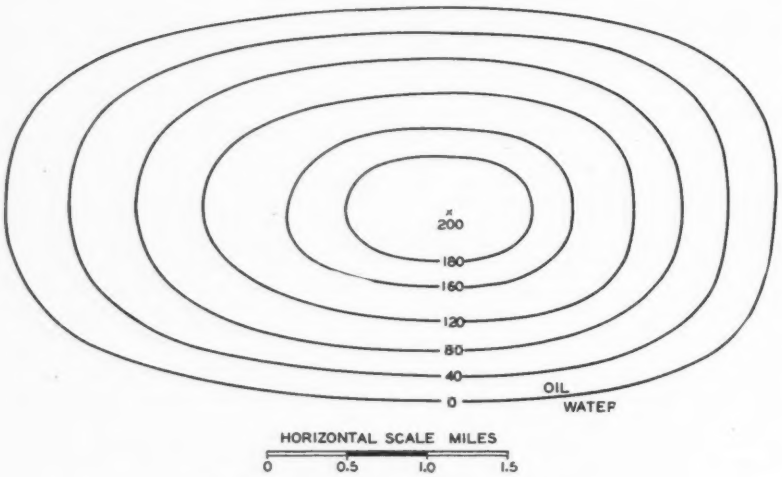


Fig. 19-1—Contours on top of the E-1 reservoir

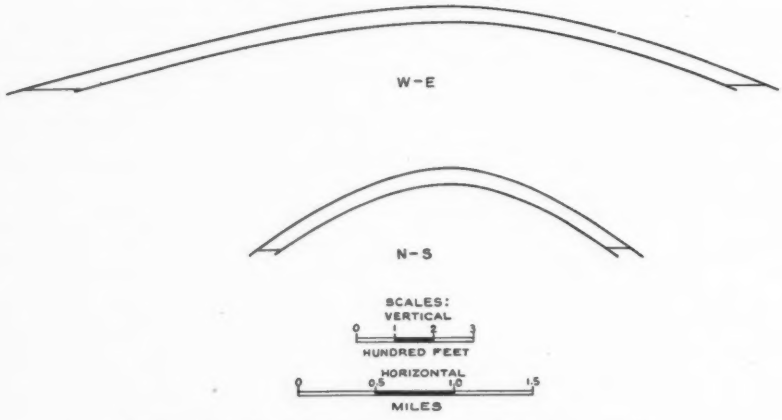


Fig. 19-2—W-E and N-S sections through apex of the E-1 reservoir

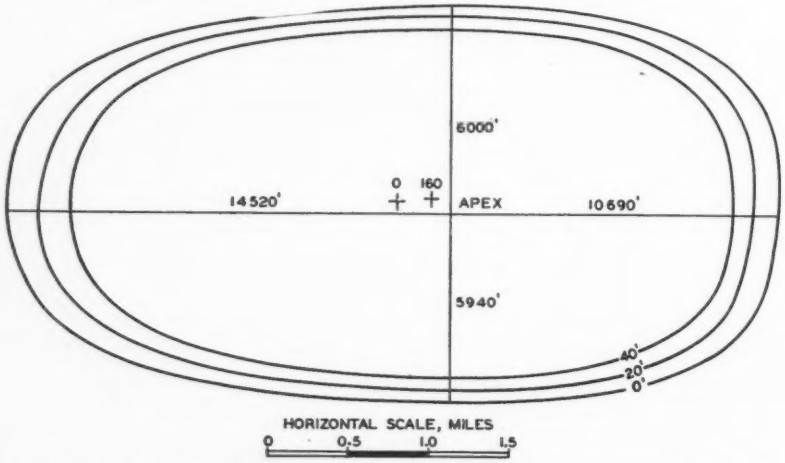


Fig. 19-3—Pay thickness, apex, and the center of area for the zero and 160-ft. levels in the E-1 reservoir

Structure and Stratigraphy

CONSIDER the reservoir mapped out in Figs. 19-1 through 19-3. This is an elongated structure and is called the E-1 reservoir. Contours on top of the E-1 reservoir are given in Fig. 19-1. The major axis is about twice the length of the minor axis. The closure is 200 ft. The point denoted by X is the apex. The sections shown in Fig. 19-2 are W-E and N-S through the apex.

The pay-thickness contours are shown in Fig. 19-3. The productive area is 6,220 acres. There are 217,700 acre-feet of pay. Pay thickness averages 35 ft. The intersection of the two sets of short lines defines the center of the zero and 160-ft. contour. Production is by encroaching, or injected, edge water between the zero and 160-ft. levels.

Average Radial Distance

The apex of the E-1 structure is at the intersection of the major and minor axes shown in Fig. 19-3. The distance from the apex to the water contact varies from 5,940 up to 14,520 ft.

The center of the area for the zero level is at the point denoted by zero. The center of the area for the 160-ft. level is at the point denoted by 160. The distances to water along the east and west semimajor axes from the center of an area are equal. Similarly, the distances to water along the north and south semiminor axes are equal.

Define the area at any level by:

$$a = 3.14r^2 \qquad (1)$$

where "a" is productive area in acres and r is the average radial distance to water. As there are 43,560 sq. ft. per acre, it follows that r in feet is given by:

$$r = 117.8(a)^{1/2} \qquad (2)$$

Let r_1 and r_2 be distances to water as defined by Equation 2. Let B denote the distance advanced by an oil-water interface along the top of pay. Then:

$$B = r_1 - r_2 \qquad (3)$$

Acre-Feet and Distance

The ah curve in Fig. 19-4 gives the acre-feet of pay below any elevation

*Production consultant, Houston.

TABLE 19-1—DISTRIBUTION OF PAY IN THE E-1 RESERVOIR

Elevation	Acres			Acre-feet		Distance	
	Top	Bottom	A	ah	Σ ah	r	B
	6,220	4,650	1,570		.....	9,230	....
			1,505	60,200			
40	4,650	3,210	1,440		60,200	3,030	1,200
			1,340	53,600			
80	3,210	1,970	1,240		113,800	6,680	2,550
			1,150	46,000			
120	1,970	910	1,060		159,800	5,230	4,000
			985	39,400			
160	910	....	910		199,200	3,550	5,680
			610	13,200			
180	390	....	390		212,400	2,300	6,930
			215	5,300			
200	40	....	40	.....	217,700	....	....

TABLE 19-2—CUMULATIVE OIL RECOVERY FOR THE E-1 RESERVOIR

Thousand feet	Thousand acre-feet			Million barrels of oil*		
B	B	M	(B — M)	M	(B — M)	Cumulative
0.25	13	None	13	....	3.5	3.5
0.50	25	None	25	....	8.3	8.3
0.75	38	None	38	....	14.8	14.8
1.0	50	None	50	....	22.5	22.5
1.5	73	23	50	15.6	22.5	38.1
2.0	95	47	48	32.0	21.6	53.6
2.5	114	70	44	47.6	19.8	67.4
3.0	131	90	41	61.2	18.5	79.7
3.5	147	109	38	74.1	17.1	91.2
4.0	160	126	34	85.7	15.3	101.0
4.5	173	141	32	95.9	14.4	110.3
5.0	185	156	29	106.1	13.0	119.1
5.68	199	174	25	118.3	11.3	129.6
6.80	212	199	13	135.3	5.8	141.1

*At 680 bbl. per acre-foot for M and 450 for (B — M) when B > 1,000 ft.

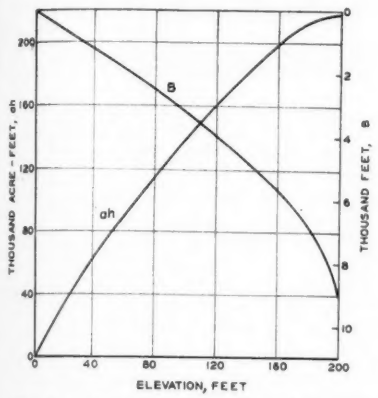


Fig. 19-4—Acre-feet of pay ah and average distance B along top of pay vs. elevation in the E-1 reservoir

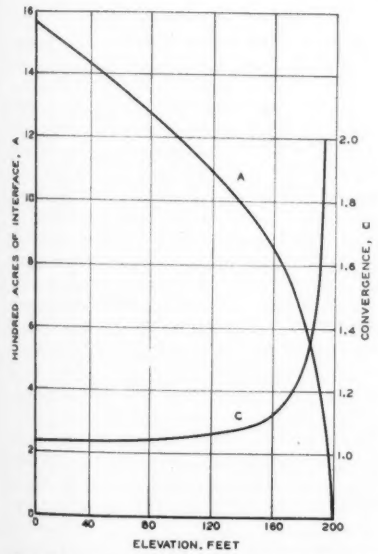


Fig. 19-5—Acres of oil-water interface A and convergence of reserve C in the E-1 reservoir

in the E-1 reservoir. The B curve shows the average radial distance along the top of pay. Distances are relative to the water contact and denote the average distance as defined by Equations 2 and 3.

For instance, the average radial distance along the top of pay to the zero level is 9,230 ft. by Equation 2. The corresponding distance to the 40-ft. level is 8,030 ft. The difference (9,230 — 8,030) or 1,200 ft. is the average distance advanced by water in going from the zero to the 40-ft. level along the top of pay in the E-1 reservoir.

Convergence of Reserve

Consider the acres of oil-water interface at various levels in the E-1 reservoir. There are 1,570 acres of interface at the zero level. At the 200-ft. level, the area is equal to zero. The A curve in Fig. 19-5 shows the acres of interface at various levels.

Let A denote the interface area at a given level and "a," the interface area 1,000 ft. updip from the given level. Convergence of reserve is defined approximately by:

$$C = \frac{2A}{A + a} \qquad (4)$$

The C curve in Fig. 19-5 is a solution of Equation 4 for the E-1 reservoir. Convergence starts at 1.04 and increases up to 2.0 along the crest of the structure.

The invaded acre-feet corresponding to the average distance advanced by water along the top of pay is given by the B curve in Fig. 19-6. The acre-feet of pay below the level at (B — 1,000 C) is shown by the M curve. The distribution of pay for the E-1 reservoir is also itemized in Table 19-1.

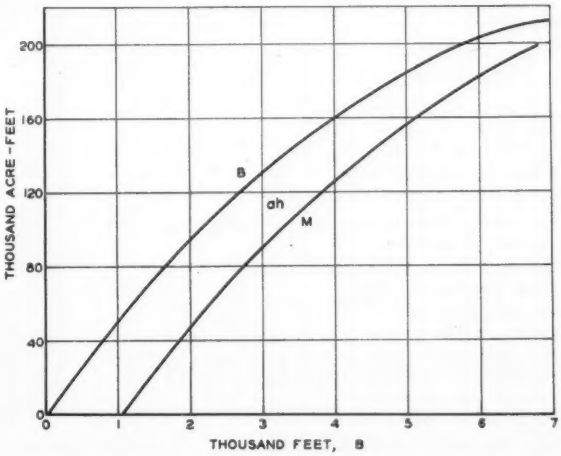


Fig. 19-6—(Right) Acre-feet of pay below the B and M contours vs. the average distance advanced by the B contour in the E-1 reservoir; position of the M contour is (B — 1,000C) ft. downdip from B

Recoverable Oil

The E-1 reservoir contains 217,700 acre-feet of pay. For illustrative purposes, let the porosity, interstitial water, viscosity and volume factor be such that water can displace 680 bbl. per acre-foot. The corresponding recoverable oil for the reservoir is approximately 148 million barrels. The 148 million barrels of recoverable oil is aside from economic limits on per cent cut in production and aside from (1) structural and stratigraphic trapping of oil, and (2) trapping of oil by water because of excessive rates of production.

Let the fluid factor F equal 4.0. The in-place oil is about 680/(80 — 4) or 895 bbl. per acre-foot. When water first invades an acre-foot of pay, the oil displaced ahead of water before water starts passing through is about (28 — F) per cent of the in-place oil. This is the breakthrough recovery and is equal to 895(0.24) or approximately 215 bbl. per acre-foot. As more water invades a given acre-foot of pay, the oil displaced increases from (28 — F) up to (80 — F) or from 215 up to 680 bbl. per acre-foot in the present example.

The oil displaced from the acre-

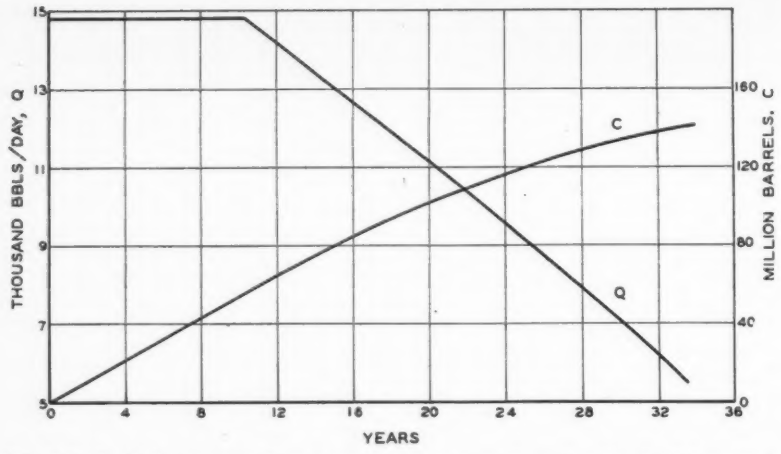


Fig. 19-7—Producing capacity Q and cumulative recovery C vs. time for the E-1 reservoir produced at MER and 6,000,000 bbl. by expansion

feet below an M contour is 100 per cent of the recoverable oil or 680 bbl. per acre-foot. The oil displaced from the acre-feet between a given set of B and M contours ranges from 215 bbl. per acre-foot at the B contour up to 680 bbl. per acre-foot at the M contour.

Productive area in elongated reservoirs is proportional to the square of the average radial distance. This is the same rule as for radial reservoirs. But the displacement factor for the B-M region in radial reservoirs is about two-thirds of the recoverable oil. Hence, the displacement factor for the E-1 reservoir up to the 160-ft. level is 680(0.67) or 450 bbl. per acre-foot in the B-M region.

During the development of the B-M region, the displacement factor increases in the present example from 680(28 — F)/(80 — F) or 215 bbl. per acre-foot up to 450 bbl. per acre-foot. The displacement factor is assumed to increase linearly for a developing (B — M) region. The corresponding values at 250, 500, 750, and 1,000 ft. updip from the water contact are 270, 330, 390, and 450 bbl. per acre-foot respectively.

Cumulative Recovery

The estimated cumulative oil recovery for the E-1 reservoir is itemized in Table 19-2. The first column is the average distance advanced by the oil-water interface along the top of the pay. The second and third columns were obtained from Fig. 19-6.

About 141 million barrels can be produced by the time the M contour reaches the 160-ft. level in the E-1 reservoir. As the recoverable oil is 148 million barrels, about 95 per cent of the recoverable oil can be displaced by edge water. Above the 160-ft. level, displacement is by bottom water.

The slope of the cumulative recovery curve in Fig. 19-7 gives the producing capacity for the E-1 reservoir. The initial capacity is about 14,800 bbl. per day. This rate can be maintained for about 10 years provided cumulative recovery by expansion is about 6 million barrels. The expansion is about 3 per cent of in-place oil. Reservoir capacity declines down to about 5,000 bbl. per day by the end of the thirty-fourth year. The data are for a MER of 200 ft. per year.

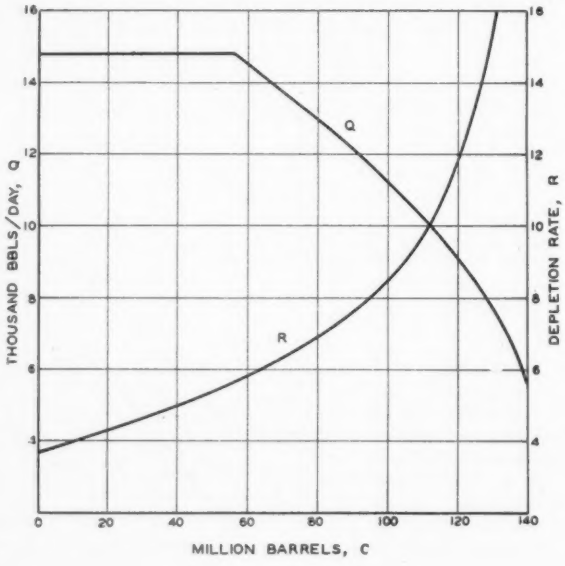


Fig. 19-8 — Producing capacity Q and depletion rate R vs. cumulative recovery C for the E-1 reservoir produced at MER by one oil-water interface and 6,000,000 bbl. by expansion; rate of depletion is in per cent per year of recoverable oil

Distances are defined by

$$117.8(a_o^{1/2} - a^{1/2})$$

where a_o is the acres enclosed by the water contact, zero-oil contour and "a" is the acres enclosed by any other contour updip from the zero contour.

The estimated producing capacity for the E-1 reservoir is plotted against cumulative recovery in Fig. 19-8. The corresponding rate of depletion is indicated by the R curve. The recoverable oil is 148 million barrels. So the rate of depletion in per cent per year of recoverable oil is defined by 365Q/(148 — C) where C is cumulative recovery in million barrels.

Application to Cycling Of Gas Injection

(Continued from page 89)

confine the return of gas to the second stringer, which in both wells was below water level. The latest information from field tests indicates that the dry-gas content of the well effluent from the southernmost extraction well has not increased and possibly, may have decreased, somewhat. This would indicate that the rate of invasion into that area has been checked by reason of the elimination of injection into the top sand segments in Wells "C" and "F"; and, further, it is direct evidence of the effeciveness of the injection into the water sands of these two wells.

Application in Sand "B" of Field "B"

The second reservoir in Field "B" to which the method of below-water injection has been applied successfully will be termed Sand "B." One well in this sand has been so completed, with 33 ft. of pay exposed above gas-water contact and a 24-ft. interval of water sand open by perforations below the contact. The significance of this example is that it illustrates impressively the integrated utilization of an available well for more than one purpose, thereby enhancing the possibility of increased ultimate invasion, and, at the same time, precluding the necessity of providing an additional well.

The configuration of the subject reservoir is shown in Fig. 8. The flood-pattern in this sand is for end-to-end sweep, with injection provided by one well, designated Well "X," and the other five wells serving as producers.

The premature "break through" of dry gas into Well "B" prompted a revision of the interpretation of the structure. It was found possible to separate the reservoir into two sections, principally by reason of variation in permeability of the upper and lower portions. Potentiometric analysis, based on this revised concept of the structure, substantiated

the invasion of Well "B," and indicated that invasion was through the lower section of the sand, with the dry-gas wave front in the upper section being considerably retarded.

The drive in the lower section of the sand had been furnished by injection into Well "X." This well originally had been completed in the conventional manner, with the exposed sand interval lying above gas-water contact; but several months subsequent to the start of cycling operations, the well was reworked to provide for injection into the lower section of the sand, which lay below the contact. The purpose, at the time, for the inclusion of the water sand in the interval exposed to injection in this well, was an attempt to improve the ultimate invasion of the reservoir. On the basis of the later concept of the structural conditions, it appears probable that eventual provision for injection into this lower portion of the sand would have been required, either as presently provided in the water sand of Well "X," or by the drilling of an additional well. The earlier utilization of Well "X" for this purpose hastened the realization that the upper and lower portions of this sand probably would require separate cycling, in parallel or otherwise, thereby placing the program at an early date on a more reasonable basis.

The operating experience on Well "X," in regard to the injection of gas into the water sand, has been satisfactory. The effectiveness of the operations apparently is substantiated by potentiometric studies, which indicate that the volume of gas computed to have been returned to the lower portion of Sand "B," through the water sand exposed in Well "X," closely approaches the calculated volume required to invade Well "B" in the allotted time.

Application in Field "C"

The final case experience of below-water gas-injection to be cited involves a relatively small gas-condensate reservoir in a field, which shall be termed Field "C," located in Southwest Texas.

Subsurface characteristics and conditions existing in the reservoir in question dictated cycling operations for the attainment of optimum depletion. Economically, it was advisable to utilize wells already drilled, if such were suitably located. Two wells were available for extraction purposes, but no well, with a sufficient section of the sand above gas-water contact, was available for input service.

One well, however, which would conform acceptably with the contemplated plan of cycling as an injection well, had been abandoned without setting pipe, for the reason that the well was too low structurally to warrant completion. This well had topped the subject reservoir at a depth of approximately 23 ft. below the gas-water contact, and the top of the sand was estimated to be 400 ft. laterally from water level. In view of the successful application of below-water gas-injection in other fields, it appeared feasible to attempt such utilization of this well.

Accordingly, pipe was set and completion was made with an interval of 32 ft. being exposed by gun perforations opposite the water sand. The initial tests were successful, and the well now has been in service for approximately 6 months. Volumes of 4 to 5 million cubic feet per day are being returned through this water sand at normal wellhead pressures of 2,900 to 3,000 psi. The sand is estimated to possess a permeability of 200 md.

Acknowledgment

The writer wishes to express his appreciation to the Katy Field Operators' Committee, Humble Oil & Refining Co., The Texas Co., and Tide Water Associated Oil Co. for permission to prepare and publish this paper, and to J. W. Foley of The Texas Co. and W. H. Vaughan and W. H. Justice of Tide Water Associated Oil Co. for their helpful suggestions.

FOR THE BEST IN CABLE TOOLS

Fig. F460 Fig. F467

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(Fig. F460)
THREE-PRONG GRAB
(Fig. F467)

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Carbon Black

Faces Progressive Changes

by George Weber

THE carbon-black industry is undergoing a transition unparalleled in its 75-year history in this country. Economic and technological changes, begun a number of years ago, have received tremendous impetus from war and postwar demand for record volumes of carbon black in an expanding variety of grades.

The important factor underlying this change is the conversion of a sizable fraction of carbon-black production to the furnace process. In comparison with the original channel method for obtaining carbon black from natural gas, the furnace process offers: (1) higher yield, (2) wider range of products, (3) possibilities for further improvement and diversification of products.

While it owes its great expansion to war demand, the furnace process is by no means a "war baby." It is economically sound, for it provides greater efficiency at a time when manufacturing costs are rising sharply. In addition to the normal increase in operating costs, carbon-black manufacturers have been paying successively higher prices for natural gas. Formerly utilizing low-value gas, either too sour or too remote to attract other buyers, the industry is now meeting added competition in contracting for its raw material. Such competition may be expected to stiffen as new outlets and uses develop for both sweet and sour gas.

Furnace blacks, at one time considered inferior to channel blacks, now enjoy a heavy demand for uses to which they are particularly adapted. Technique is rapidly narrowing the physical differences between the two types of black. Moreover, the versatility of the furnace process as compared with the rigid limits to improvement offered by the channel process, indicates that further refinements may produce furnace blacks which can compete directly with channel products.

But the changeover to furnace black is still limited by the demands of rubber companies which constitute 95 per cent of the domestic market for carbon black. Channel blacks have not yet been duplicated on a commercial scale by furnace methods, and buyers' insistence on these types will require continuation of channel methods unless or until furnace methods demonstrate their ability to produce blacks of similar characteristics.

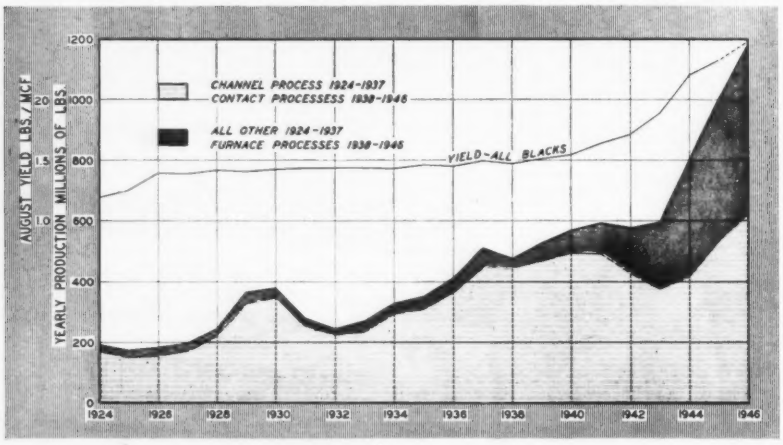


Fig. 1—(Above) The great increase in carbon black production since 1943 is illustrated in this chart, taken from U. S. Bureau of Mines figures. Early production figures are not available on furnace black alone since that type of black was bulked with thermal and contact process black other than channel black up to 1937. The improvement in over-all yield since 1941 reflects the great increase in furnace black production

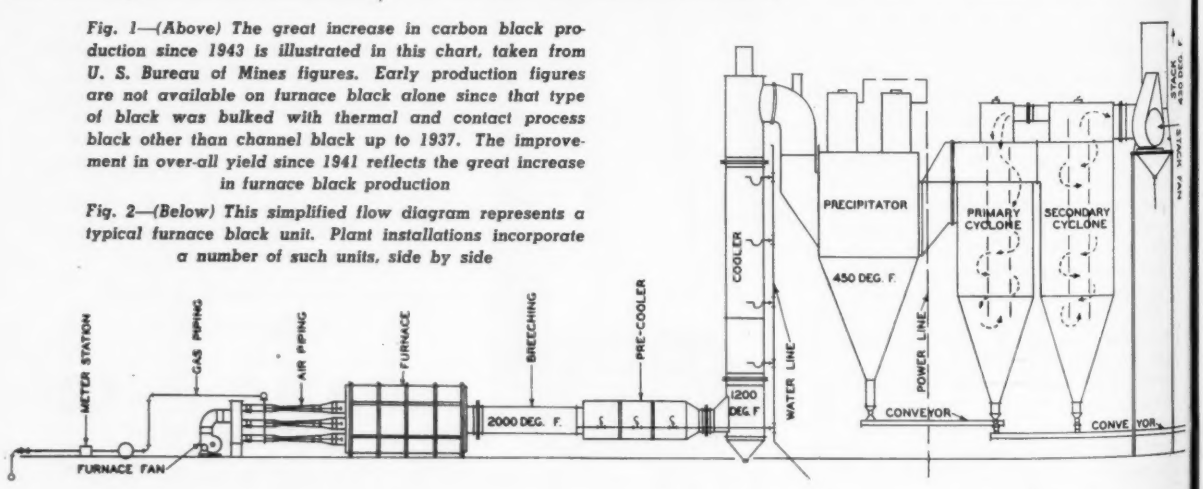


Fig. 2—(Below) This simplified flow diagram represents a typical furnace black unit. Plant installations incorporate a number of such units, side by side

History of Furnace Process

As shown in Fig. 1, furnace-black production has expanded from a minor fraction of output prior to the war, to account for nearly half the total carbon-black output for 1946. In 1920 came the first departure from the original contact processes featuring the channel, disk, plate, and roller methods. The Thermatomic process, first introduced commercially at Monroe, La., employed thermal decomposition of gas flashed by cycles into heated brick-packed chambers. The true furnace, or free-flame, method in most general use today was developed also at Monroe by Chauncy Matlock whose first plant, constructed in 1921, was later pur-

chased by Columbian Carbon Co. Several years later, a similar plant was constructed by General Atlas Carbon Co. in the Texas Panhandle.

A number of years elapsed before any more furnace plants were built, and for 15 years furnace plants played a minor role in the industry. The pioneering companies continued research on furnace methods, however, and perfected numerous refinements improving yield and quality of product. This development work proved highly important at the war's beginning, for it provided the industry with a proven, high-yield process for meeting a critical carbon-black shortage. Furnace black became particularly important since it was required in greater volumes for blending with synthetic rubber. Columbian Carbon Co., leader in the furnace-black field, increased production of that product over 40 fold in a period of about 4 years.

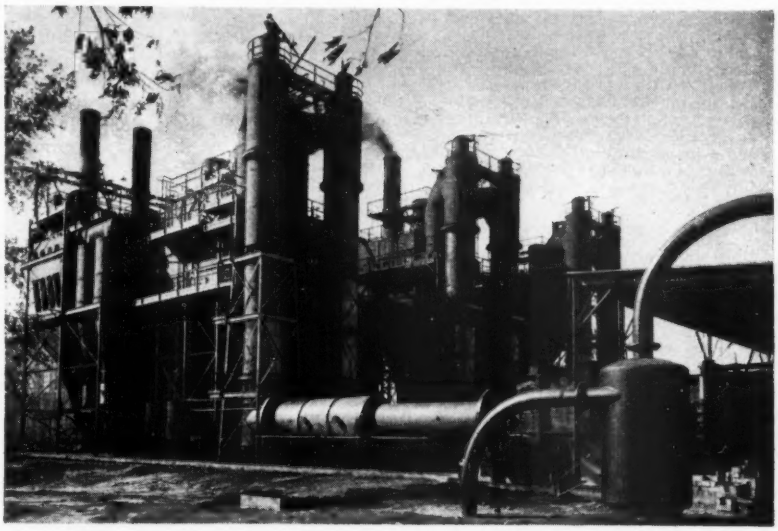
Total production of furnace black jumped from about 100 million pounds in 1940 to over 514 million pounds in 1945. During the same period channel-black output declined until 1944, when new plant installations boosted production to a 1945 total of about 540 million pounds. The first postwar calendar year, 1946, found furnace black holding its market, about 50 per cent of total.

At the present time, a total of 59 carbon-black plants are in operation in six western states. Texas plants produce about 70 per cent of total output, trailed by Louisiana, Kansas, Oklahoma, New Mexico, and California.

Furnace black is produced in 16 plants, including one which uses liquid hydrocarbons instead of gas (see Table 1). The average yield of furnace plants is 6 lb. per M.c.f., as compared with about 1.5 lb. per M.c.f. for channel plants. Gas-fired furnace plants in 1946 produced 50 per cent of product from less than 20 per cent of gas so utilized. Total present productive capacity for all types of carbon black may be roughly estimated at 1,200 million pounds per year.

Products Now Specialized

Furnace and channel blacks differ principally in particle size. Channel black particles range from 10 to 30 mμ (1 mμ equals one-millionth of a millimeter) while furnace blacks now produced commercially range from about 37 to about 270 mμ. There is no "superior" type of carbon black for



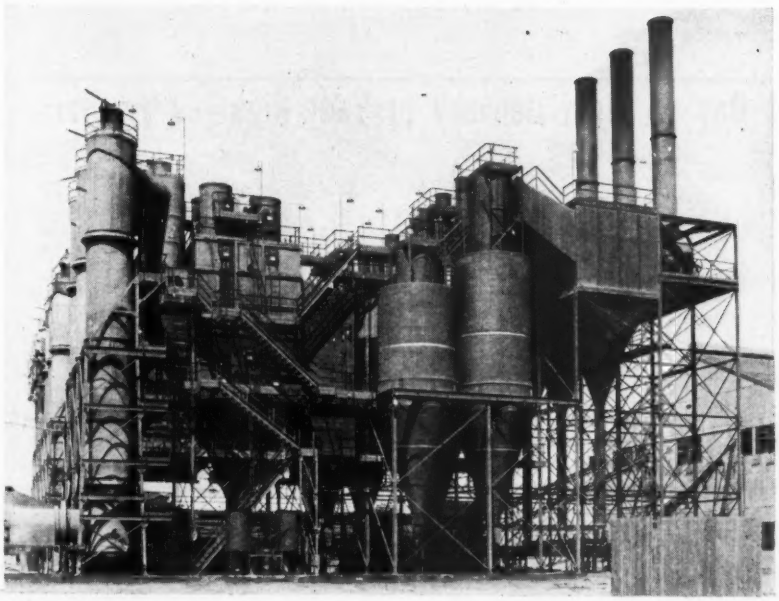


Fig. 3—(Top photo) Behind the inlet gas scrubber at the right is the horizontal furnace. The breeching and the horizontal precooler are visible to the left of the furnace, followed by vertical coolers, precipitators, and cyclone separators

Fig. 4—(Right) The precipitator and cyclone separators, shown in detail here, are heavily insulated. The furnace black plant recovers almost all carbon formed in the flame cloud, as is illustrated by the thin smoke emitted by the stacks at the right

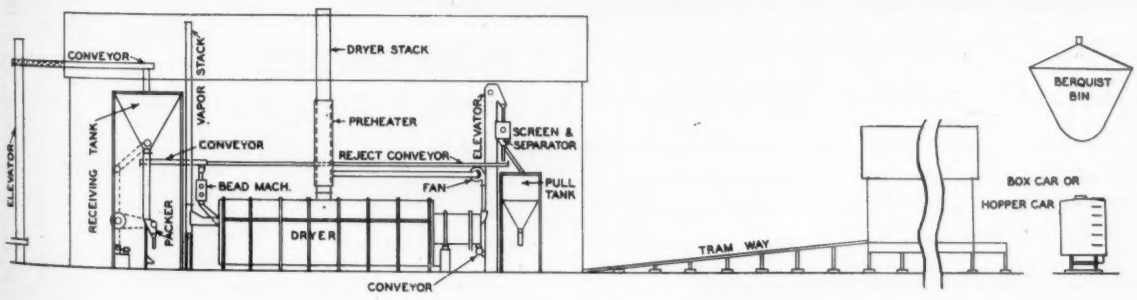


TABLE 1—OPERATING FURNACE-BLACK PLANTS

Company and plant location (gas source shown in parentheses)—	Estimated daily gas capacity (M.c.f.)
Kansas:	
Columbian Carbon Co., Hickok (Hugoton)	19,000
United Carbon Co., Ryus (Hugoton)	39,000
Louisiana:	
Cabot Carbon Co., Ville Platte (Ville Platte)	24,000
Columbian Carbon Co., Eola (Eola)	8,000
Southern Carbon Co., Monroe (Monroe)	6,000
Oklahoma:	
Cabot Carbon Co., Guymon (Hugoton)	8,000
General Atlas Carbon Co., Guymon (Hugoton)	6,000
Texas:	
Columbian Carbon Co., Conroe (Conroe)	11,000
Columbian Carbon Co., Fortune (Fairbanks)	8,000
Columbian Carbon Co., Seagraves (Wasson)	16,000
Continental Carbon Co., Sunray (Panhandle)	12,000
General Atlas Carbon Co., Pampa (Panhandle)	13,000
J. M. Huber Corp., Borger (Panhandle)	20,000
Jefferson Lake Sulphur Co., Clemens dome	2,000
Phillips Petroleum Co., Borger—liquid hydrocarbons	
United Carbon Co., Aransas Pass (Aransas Pass)	7,000

all uses. Each grade has qualities which make it best for specific uses in rubber blending or pigmentation.

Channel blacks in the 25-30 mμ range are demanded by tire manufacturers for blending toughness and long wear into tire treads. Furnace blacks with larger particle sizes impart less hardness and decrease heat generation of rubber and are preferred for the carcass of the tire which receives much stress in use.

Synthetic-rubber tires require greater quantities of black of the furnace type. They show less resilience than natural-rubber tires, therefore, more of the stress applied to them is converted into heat. Heavy blends of furnace blacks in such tires reduce heat and so greatly improve service life.

Intensity of blackness varies inversely with particle size. But an inherent blue undertone in furnace blacks as compared with the grey undertone of channel blacks gives the former type preference for some pigmentation uses. Furnace blacks, recovered at higher temperatures, contain much less volatile matter than channel blacks.

At present six companies market over 15 brands of furnace black. Table 2 outlines the four principal types and their general characteristics.

Semireinforcing furnace black was the original type produced by the free-flame method, and is the commonest today. It is preferred for blending with synthetic rubber in making rubber hose, rubber heels, and other products requiring flexibility with moderate strength. It is also widely used with natural rubber for manufacture of boots and other wearing apparel, industrial and air brake hose, and rubber bumpers.

High-modulus furnace black imparts added strength and firmness to rubber. It reinforces rubber more than semireinforcing furnace and was found especially valuable during the war for fabricating tank treads and heavy-duty truck tires. This type of black allows synthetic rubber to withstand heavy loads and shocks, where long wear is not the exclusive requirement.

TABLE 2—TYPES OF FURNACE BLACK

Name—	Symbol	Avg. yield, lb./M.c.f.	Particle size, millimicrons	Properties
Conductive furnace	CF	....	(32-34) 37	High heat and electrical conductivity
Fine furnace	FF	4-5	(36) 41	Toughness, resistance to abrasive wear, cool running
High modulus furnace	HMF	....	(47) 55	High modulus of elasticity, low heat generation
Semireinforcing furnace	SRF	10-12	80-90	Moderate reinforcement plus high loading capacity and good flexibility

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Liberal, Kans.	1386-L
Seminole, Okla.,	1901
Shawnee, Okla.	586
Tulsa, Okla.	3-6143
Hobbs, N. M.	275-R

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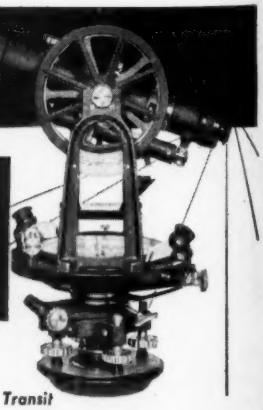

Illustrated, famous Type II Transit

Conductive furnace black is valuable as a good conductor of both heat and static electricity. Research was completed on this black and production began early in the war. It is used in heavy blends for heat dissipation in synthetic tires, and finds particular use in aircraft tires, for carrying off static electrical charges on landing. This latter property makes it adaptable for tires mounted on buses and gasoline trucks.

Fine furnace black is a product which approximates channel black and is used to impart hardness and resistance to abrasive wear into rubber. As compared with other furnace blacks, it has a low yield, since yield and particle size are directly related. This type of black is now the object of much research in an effort to produce a product with channel-black characteristics but greater yield than channel methods allow.

The Furnace Method

The free-flame method employed in the furnace process is a definite departure from the contact method which recovers carbon black deposited on a cool metal surface by a gas flame burning in insufficient air. The principle of the furnace process is outlined in Fig. 2. Gas, partially burned in the furnace, forms a flame cloud with a temperature exceeding 2,000° F. At that temperature, thermal decomposition of the unburned hydrocarbons takes place, and finely divided, free carbon passes with the combustion gases through a breeching to the precooler where the mixture is quenched to about 1,200° F. Further contact with water sprays in the brick-lined cooler depresses the temperature to about 450° F.

In passing through the electrical field of the precipitator, the carbon particles become ionized, and particles of opposite charge join or agglomerate into particles of greater mass. The larger particles, or flocs, settle directly to the base of the precipitator. Most of the product remains entrained in the gas flow. Those particles are then whirled downward in a spiral motion in the two cyclones, where by centrifugal force, they collect at the bases of the vessels and are moved by screw conveyor to the receiving tank. Stack gas at 430° F. from the secondary cyclone is vented with only a trace of carbon lost as smoke.

Much carbon black is now pelleted to facilitate handling during shipment. Water is added and the product is pressed into beads resembling buckshot. After drying, the beaded product can then be handled with a minimum of dust and waste. Figs. 3-7 illustrate some of the plants and facilities of Columbian Carbon Co.

Process Is Flexible

The methods for mechanical recovery of carbon from the flame cloud

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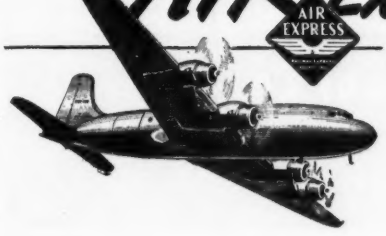

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Fig. 208

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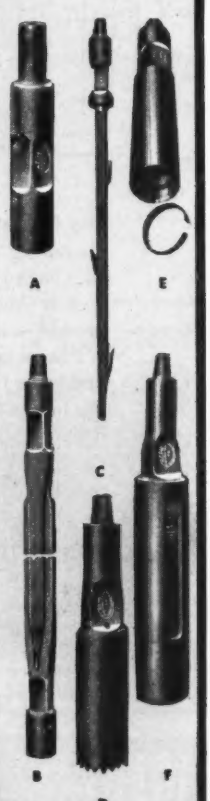

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are fairly standard in all furnace plants. Various installations differ principally in the design of that section of the plant including the furnace, breeching, and precooler. There the variation of a number of factors gives the furnace process great flexibility. Yield and quality of product are determined not only by the air-gas ratio employed, but also by the temperature and contact time before precooling. These latter factors are in turn affected by the size and shape of burners, burner tips, furnace, breeching, and precooler.

Close control of all elements of the process is necessary to produce a uniform product. Very accurate controls, meters, and recording instruments are required to maintain a constant furnace input of air load, blast gas, and make gas. A small variation in this air-gas ratio, for example from 5.4 to 1 to 5.5 to 1 will result in different products. Incoming gas must be of uniform composition, since both the oxygen requirements and the combustion heats of its hydrocarbon components vary widely. Temperature of the flame cloud must be held within the range of a few degrees. Contact time, governed by the volume of input, size and shape of the furnace and length of the breeching, must be controlled to an accuracy of 0.2 second.

The initial cost of a furnace plant runs high; about twice that of a channel plant with the same carbon-black output. New construction of furnace plants will hardly continue the record pace of the past 4 years. Furnace-plant investment will in the future be governed more closely by the degree of improvement which the process offers over channel methods.

Z. S. Biglane, formerly an independent oil marketer, has joined Great National Oil Corp. of Louisiana, Shreveport, as sales and purchasing agent. Biglane also has been sales engineer with the old Louisiana Oil Refining Corp., Hurricane Petroleum Co., and for 8 years sales engineer for **M. J. Grogan,** president of Rodessa Refining Corp.

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Percentage Vaporized By Pressure Reduction

When the pressure is reduced on a gasoline product how much of it will be vaporized? T.H.R.

A complete answer cannot be given in a simple manner because the outlet or final temperature is not known. Although the outlet temperature can also be computed, the mathematics is so complicated that such formulations are almost useless.

If the final temperature and pressure are known, the amount of vaporization can be described in terms of the A.S.T.M. distillation as follows:

A.S.T.M. Slopes of 1-4

$$V = \frac{t - t_{50}}{0.65\,S_A - 0.3} + 50 \qquad (1)$$

$$= \frac{t - t_{50}}{0.0108\,(t_{70} - t_{10}) - 0.3} + 50$$

A.S.T.M. Slopes of 3-6

$$V = \frac{t - t_{50} + 55}{0.75 S_A - 0.62} + 50 \qquad (2)$$

$$= \frac{t - t_{50} + 55}{0.0125\,(t_{70} - t_{10}) - 0.62} + 50$$

in which:

V = vapor, l.v. per cent
t = final temperature, °F.
t_{10} = 10 per cent A.S.T.M. temperature
t_{50} = 50 per cent A.S.T.M. temperature
t_{70} = 70 per cent A.S.T.M. temperature
S_A = Slope of A.S.T.M. deg./%

$$S_A = \frac{t_{70} - t_{10}}{60}$$

Note that the A.S.T.M. temperatures are those of the feed stock or entire material. The equations should not be used for freak materials which exhibit great curvature.

Pressure—Equations 1 and 2 are based on atmospheric pressure. If the final separation at the temperature "t" is under pressure, the equations are still satisfactory except that "t_{50}" (the 50 per cent A.S.T.M. temperature) must be corrected to the new pressure by using a vapor pressure chart for the paraffin hydrocarbons. If the outlet pressure is higher than 100 psia., better accuracy is obtained by correcting "t_{70}" and "t_{10}" for the pressure, as well as "t_{50}."

Derivation—Equations 1 and 2 were derived as follows: The relationship of the flash or equilibrium vaporization curve is reported graphically on page 242 of the second edition of Petroleum Refinery Engineering. The relationship is not linear, but throughout short ranges, such as 1 to 4 and between 3 and 6, a linear relationship may be assumed without introducing serious inaccuracy. The equation relating the slopes of the A.S.T.M. and flash distillation curves for materials having A.S.T.M. slopes between 1 and 4 (such materials as gasoline, kerosene, diesel fuel, distillate fuels, and most gas oils) is:

$$S_F = 0.65 S_A - 0.3$$

in which S_F is the 10-70 slope of the flash vaporization curve expressed as degrees per per cent.

The flash vaporization and A.S.T.M. distillation curves cross at the 50 per cent point or temperature and hence, the equation of the flash curve may be described as:

$$t = (t_{50} - 50 S_F) + S_F V$$

$$= t_{50} + (V - 50)\, S_F$$

$$V - 50 = \frac{t - t_{50}}{S_F}$$

$$V = \frac{t - t_{50}}{0.65 S_A - 0.3} + 50$$

References to Refrigeration

We need tables for determining the refrigeration effect that is obtained when gasoline, propane, butane, and pentane plus vapors, in fact the vapors of any of the common hydrocarbons, are discharged from one pressure to a lower pressure. Complete data will be gratefully received. T.H.R.

It is presumed that the question refers to the free expansion of a gas or vapor through a throttling valve. Such an expansion occurs at constant enthalpy whereas the expansion of gas or vapor through an engine so that work is done occurs at constant entropy.

Numerous charts pertaining to the many different hydrocarbons and mixtures of them have been published. Some of them are:

(1) **Propane:** Mollier diagram, page 84 of the 1946 edition of the Technical Bulletin of the Natural Gasoline Supply Men's Association, Kennedy Building, Tulsa. Also—Laverty and Edmister, "Liquefaction and Regasification of Lighter Hydrocarbons" The Oil and Gas Journal, page 35, September 4, 1941; which has been distributed by Clarke Bros. Co., Inc.

(2) **Butane:** Mollier diagram, same references as for propane (1).

(3) **Natural gases** having specific gravities of 0.6, 0.8, 0.9, and 1.0; enthalpy-entropy diagrams, pages 74-78, Natural Gasoline Supply Men's Association, first published by G. G. Brown in the July 1944 issue of Petroleum Technology of the A.I.M.E.

(4) **Natural gases:** Isothermal decreases in enthalpy with increase in pressure, Natural Gasoline Supply Men's Association, page 54. (In order to apply to all gases, the units must be pseudo reduced temperature and pressure, absolute temperature and molecular weight).

(5) **Gases and vapors:** Enthalpy Correction, Hougan and Watson, Chemical Process Principles Charts, page or number 106, John Wiley & Sons, Inc., New York, 1946; an earlier edition of this same chart in Nelson, Petroleum Refinery Engineering, page 108, second edition, McGraw-Hill Book Co., Inc., 1941. (In terms of reduced temperature and pressure, molecular weight, and critical temperature of the mixture).

(6) **Oil vapors:** Heat Content of Petroleum Fractions, compiled by Shell Development Co., Petroleum Refiner, Vol. 24, No. 4, April 1945. (Involves U. O. P. characterization factor of the material).

If charts are not available for a particular gas (such as the materials of references 1, 2, or 3), mixtures may be handled by working with the molal average properties of the mixture. Thus, for a mixture of equal volumes (or mols) of propane, butane, and pentane gases, the average critical temperature, critical pressure, molecular weight, etc., would be used, and the charts of references 4 or 5 would apply.

References 1, 2, and 3 can be used directly by locating the point on the chart which represents the incoming temperature and pressure, and then following a constant enthalpy line to the final pressure. The temperature after throttling can be read directly at the final pressure point.

The charts of References 4, 5, and 6 cannot be used directly to obtain the outlet temperature. They simply show the enthalpy (heat content) after the expansion, or the difference in heat content before and after the expansion. The temperature change during expansion can be computed by dividing the change in heat content by specific heat of the material. Specific heat must be known for the temperature and pressure range involved.

Only Reference 6 and its chart is said to apply to petroleum fractions such as gasoline, kerosene, etc. It, however, is based on much the same original data as the other references.

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Developments in

DRILLING-MUD CONTROL

by George E. Cannon

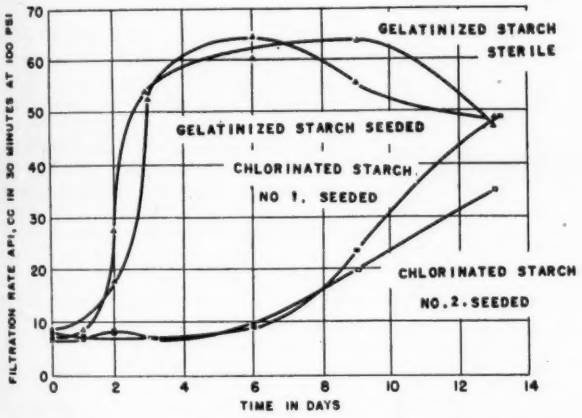
RECENTLY much of the development work in drilling-mud control has been directed at methods for more satisfactorily reducing the filtration rate of drilling mud, either by additives or by treating the clay particles present in the drilling mud. During the past year steady progress has been made in the filtration control of drilling fluids.

Several companies have been experimenting with cellulose derivates and oil-in-water emulsions to obtain low filtration rates. One company, in addition to selling a 100 per cent oil-base drilling mud, is recommending the use of the oil-base mud emulsified in natural mud to obtain low filtration rates. Approximately 10 to 20 per cent by volume of the oil-base mud mixed with a water-base natural mud will produce a mud having a filtration rate (A.P.I.) of 2 to 4 cc. Several wells have been drilled in Texas and Louisiana using the emulsion-type mud; however, sufficient data are not available to determine if the extra cost of such mud is warranted.

The author, with the petroleum engineering department of Humble Oil & Refining Co., Houston, over a long period has been intimately associated with drilling-mud improvement. In this article he summarizes some recent specialized work.

When starches and vegetable gum materials are used in drilling muds, the prevention of fermentation is of paramount importance. Fermentation can be prevented by employing either a pH of a least 10.5 or the addition of bactericides. Frequently, the cost of preventing fermentation is as much as the cost of starch. Bactericides, such as paraldehyde and sodium chlorophenol are not preferred in Gulf Coast muds because of their adverse effects on the gel properties.

Laboratory tests have been conducted on the fermentation resistance of chlorinated starch derivatives and the data obtained are shown by Figs. 1 to 4. In this series of tests, the fermentation rates of two chlorinated starch compounds are compared with that of a gelatinized starch product widely used by the industry to con-


FILTRATION RATE API, CC IN 30 MINUTES AT 100 PSI
TIME IN DAYS
GELATINIZED STARCH STERILE
GELATINIZED STARCH SEEDED
CHLORINATED STARCH NO 1. SEEDED
CHLORINATED STARCH NO.2. SEEDED

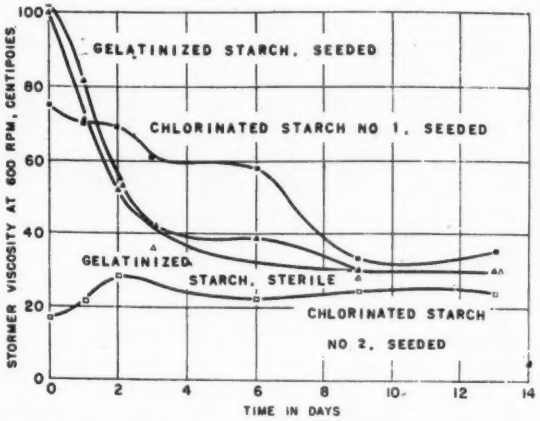
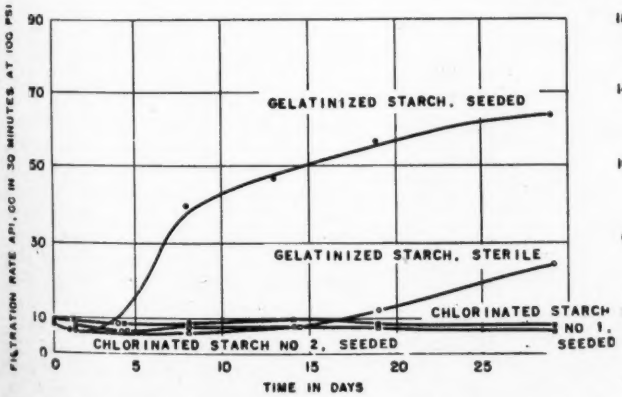

STORMER VISCOSITY AT 600 RPM, CENTIPOIES
TIME IN DAYS
GELATINIZED STARCH, SEEDED
CHLORINATED STARCH NO 1, SEEDED
GELATINIZED STARCH, STERILE
CHLORINATED STARCH NO 2, SEEDED

Fig. 1—(Left) Effect of fermentation of bacterially seeded chlorinated starch and gelatinized starch—8 per cent Zeogel in fresh water. Fig. 2—(Right) Effect of fermentation of bacterially seeded chlorinated starch and gelatinized starch on viscosity of 8 per cent Zeogel in fresh water


FILTRATION RATE API, CC IN 30 MINUTES AT 100 PSI
TIME IN DAYS
GELATINIZED STARCH, SEEDED
GELATINIZED STARCH, STERILE
CHLORINATED STARCH NO 1, SEEDED
CHLORINATED STARCH NO 2, SEEDED

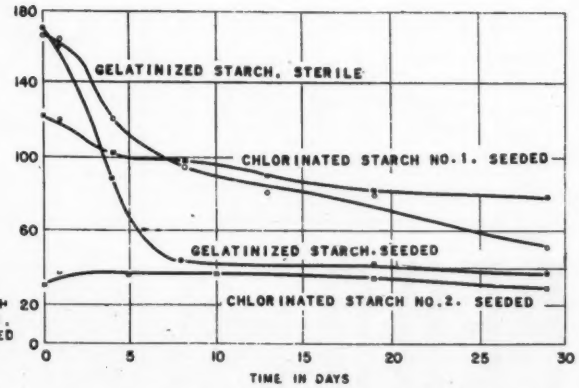


Fig. 3—(Left) Effect of fermentation on filtration of 8 per cent suspension of Zeogel in saturated salt water treated with bacterially seeded chlorinated starch and gelatinized starch. Fig. 4—(Right) Effect of fermentation on viscosity of 8 per cent suspension of Zeogel in saturated salt water treated with bacterially seeded chlorinated starch and gelatinized starch

trol the filtration rate of drilling mud. The samples were seeded with natural mud to provide bacteria for fermentation. Figs. 1 and 2 show the laboratory data on filtration rate and viscosity, respectively, using the starches referred to and fresh water mud. Fermentation of the mud containing the gelatinized starch is shown by the rapid increase in filtration rate in 1½ to 2 days. The chlorinated starch compounds resisted fermentation for approximately 6 days.

When saturated salt-water muds were employed, the gelatinized starch resisted fermentation for 4 to 5 days, as evidenced by the change in filtration rate shown by Fig. 3, while the chlorinated starch compounds did not ferment in 28 days. Fig. 4 shows the effect of the starch compounds referred to above on the viscosity of the saturated salt water mud. It is interesting to note the decrease in viscosity of the gelatinized starch-treated mud as fermentation progressed. Field tests are planned using chlorinated starch in fresh water mud. Chlorinated starch sells for approximately the same price as other starches used for filtration control.

One company has been experimenting with carboxymethocellulose as a material for controlling the filtration rate of drilling mud. Carboxymethocellulose is more resistant to fermentation than the chlorinated starches referred to above. Carboxymethocel S is slightly more effective on a per-pound basis than is starch but it now costs approximately 12 times as much as commercial starches which can be used for filtration control.

Oil-Base Drilling Mud

During 1946, three wells were completed by Humble with oil-base drilling mud. The mud used was prepared from diesel oil, ground oyster shell, and oxidized asphalt. Two of the wells, the 7 E. M. Faulk and the 7 S. H. Moore in Hawkins field, Wood County, Texas, were cored using an oil-base mud, primarily to obtain more reliable core-analysis data.

The third well, the 5 McBride, was located in Charlotte field, Atascosa County, Texas, where completion in the Navarro sand has been a problem. Cores of the Navarro sand were obtained using the oil-base drilling mud. As much as 200 hours' swabbing time has been required to complete wells drilled in the Navarro sand, and some swabbing has been required on all the wells. In the 5 McBride, 7-in. casing was set on top of the Navarro sand at 5,021 ft. The water-base mud was displaced with oil-base mud before drilling the cement plug. The well was cored to 5,106 ft. Completion was made by displacing the oil-base mud with crude oil, after which the well flowed without swabbing.

During the past year there has been a marked increase in the number of wells drilled in Texas and Louisiana using oil-base drilling mud. In general, however, the advantages gained by using oil-base mud are confined to core-analysis problems and completions in low permeability, shaly ashy sands, or tight limestone. Very little information has been obtained in the formations referred to as to the time element involved in connection with the possible harmful effects of drilling water on the flow characteristics of certain types of formations.

Lost Returns

Frequently, in drilling formations containing abnormally high formation pressures, it is necessary to use a mud weight closely approaching the overburden weight. Under such conditions, mud returns may be lost into zones of local weakness. It is questionable whether additional strings of casing set to increasingly greater depths will be of any appreciable benefit in stopping lost returns when mud weights closely approaching the overburden weight are being employed. Sealing agents, such as cane pulp and chopped cellophane, have been widely used to combat lost returns of normal-weight mud when extremely porous formations, such as gravel beds or porous lime, are being penetrated. The results obtained from using bulky materials in connection

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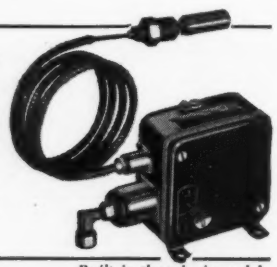
Diesel Applications: Sounds an alarm only . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

Battery Ignition Applications: Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications: Sounds an alarm only . . . grounds single or dual magneto . . . grounds magneto and sounds an alarm or lights a signal light.

Dual Ignition Applications: Opens battery circuit and grounds magneto.



Built in three basic models: oil pressure only, water temperature only, and combination model (illustrated).

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with high-weight muds to prevent lost returns have not been satisfactory.

The mechanics of lost returns in the two cases mentioned are somewhat different. The extremely porous formation receives mud into the large pore spaces and fissure already existing, whereas the relatively heavy mud creates fissures in the bedding plane between formations or other zones of local weakness, and mud enters the fissure in much the same manner cement enters the formation during a squeeze cementing job.

A squeeze-cementing technique has been developed by Humble and applied in six cases during 1946 to successfully regain mud circulation which was lost due to high mud weight. In none of the wells was the depth known at which returns were being lost into the formation. The cementing technique involves the use of a removable cement retainer if it is possible to make a trip with the drill pipe; however, in some cases, the pipe cannot be removed from the hole and because of pressure the squeeze job must be performed by closing the blowout-preventer rams or choke line.

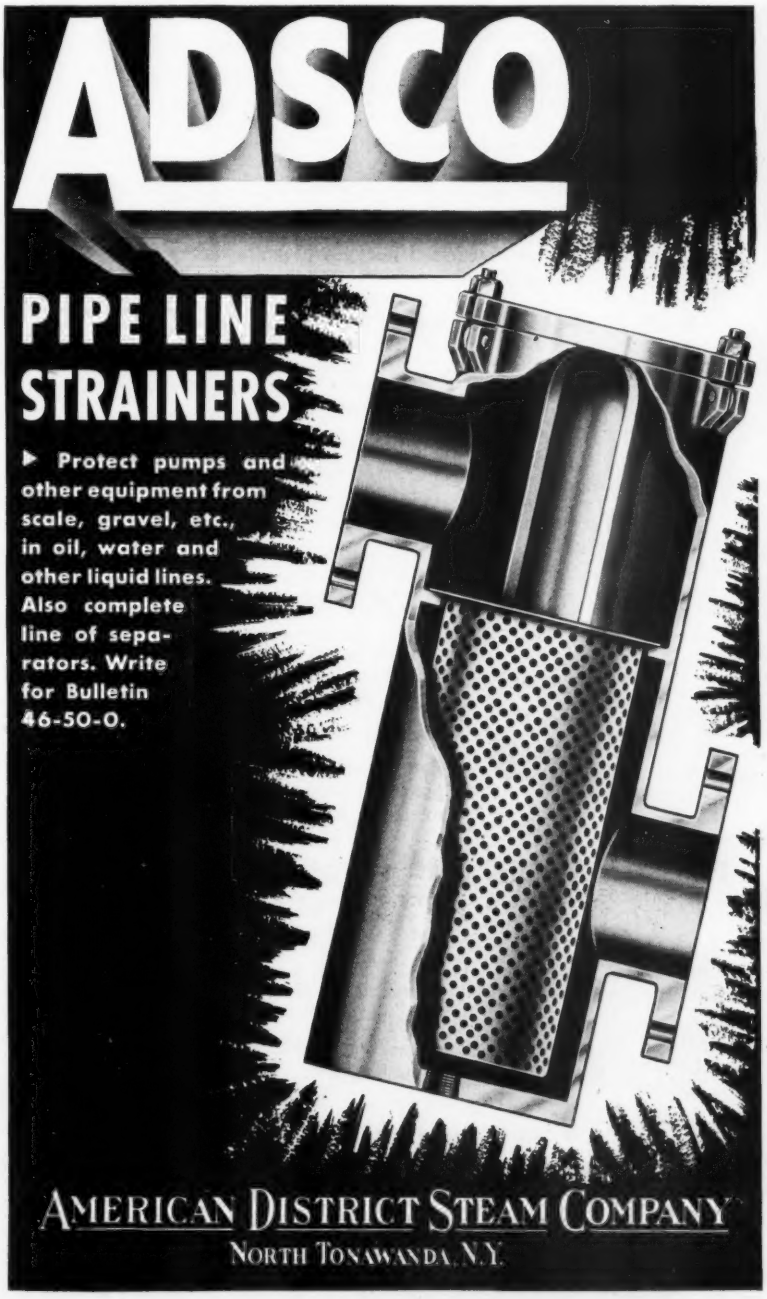
With the bit or a removable retainer at the bottom of the casing a squeeze cement job is performed using cement containing 2 to 3 per cent bentonite and 0.5 to 0.75 lb. of chopped cellophane or similar material per sack of cement. A very slow injection rate is employed and pumping is continued until a predetermined injection pressure is obtained. If there is a pressure buildup followed by a decrease in pressure, injection of cement is stopped immediately. If there is no pressure buildup during the squeezing, the cement is followed with enough mud to place theoretically the top of the cement at 50 to 100 ft. from the bottom of the hole.

Alkaline-Tannate-Lime Treatment

During the past year there has been a marked increase in the use of alkaline-tannate-lime treatment to control both the viscosity and filtration rate of drilling muds. Portland cement can be employed as a substitute for lime, and this treatment was first used by Humble in April 1938 in Lirette field, Terrebonne Parish, Louisiana. The combination referred to has been very effective in connection with high-weight muds; however, the properties of normal weight muds can be effectively and economically controlled by using lime in connection with caustic soda and quebracho. In some areas the caustic soda - quebracho - lime treatment has replaced both phosphate and starch.

Normally, it is Humble practice to use caustic soda and quebracho to control the viscosity and filtration properties of fresh-water muds as long as these materials are effective and produce the desired results because they are usually cheaper to use than other chemicals employed for this purpose. When these materials become ineffective or when lower viscosities and filtration rates are desired, it is now the practice to use lime in connection with caustic soda and quebracho or with quebracho alone.

The mixture of caustic soda and quebracho to employ is best determined by pilot test; usually, however, one part of caustic soda to more than five parts by weight of quebracho will be the most effective mixture. In some wells it is possible to employ mixtures of quebracho and lime without the caustic soda. Frequently, when lime is employed, the initial treatment causes an increase in viscosity, but after one mud cycle there is a decrease in viscosity. Day-to-day treatment during drilling varies considerably, depending on drilling rate and properties desired. The amount of lime used varies from 50 to 150 lb. per day. Very little additional caustic soda and quebracho are required and usually 150 to 200 lb. per day of each is sufficient. It has been observed that lower filtration rates can be obtained by increasing the amount of quebracho employed with the lime.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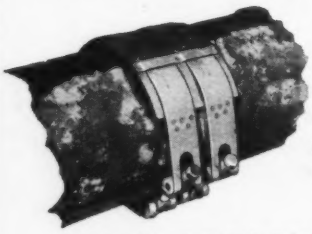

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3 types for all pipe from 2 to 8 inches.

Largest size weighs only 6 pounds.

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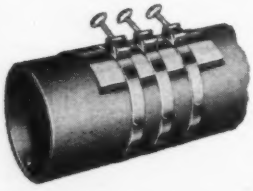

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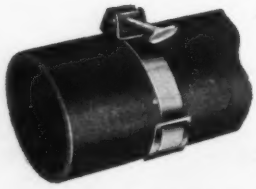

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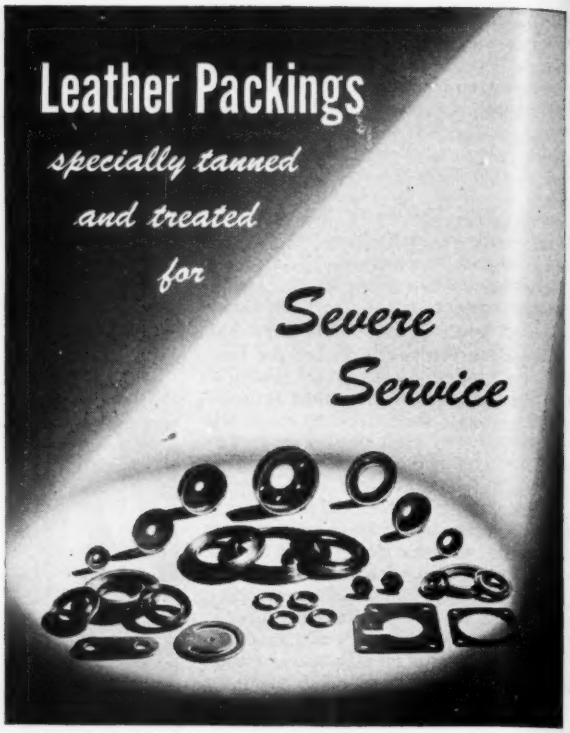

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MODERN Rotary DRILLING

Capacities aud Modern Arrangements Of Hydraulic Type Draw-Works Brakes

HYDRAULIC brakes are made in sizes 10½, 15, 22, 32, 36, and 40 in., single rotor, and 15, 22, and 40 in. double rotor. The size refers to the rotor's diameter. The capacity of a double rotor brake equals 1.7 times the capacity of a single rotor brake. It is believed that by small changes in design the capacity of a double rotor brake may be made to approach double that of a single rotor brake.

Chart in Fig. 20 shows the capacity of a 40-in. double rotor brake, set for maximum resistance. The chart differs from the usual manner of presentation of capacity of a hydraulic brake. Instead of showing the relationship between the horsepower capacity and speed of rotation of the brake, the chart shows directly the hook load which may be automatically controlled at any particular speed of lowering.

The curves in the chart bring out an important characteristic of the hydraulic brake. In addition to absorbing the energy developed during the lowering of the load, the brake acts also as an automatic governor to prevent runaway loads. It can be seen from the chart that the capacity of the brake increases approximately as the cube of the speed. Therefore, any increase in the governed load descent is immediately checked by the much larger increase in brake capacity.

The chart shows the arrangement with maximum resistance. Adjustments would be made by the regulation of this resistance. For instance, in the case it would be desired to lower the weight of 100,000 lb. with eight lines, at the speed of 380 ft. per minute, the resistance would be set so that the capacity of the brake would be approximately half of the maximum.

Modern Arrangements

Until a few years ago the hydraulic brakes were coupled directly to, or were driven through a disconnecting coupling from the draw-works shaft. Present practice is to use a pneumatically or hydraulically operated engaging coupling. One manufacturer provides an automatically operating clutch. When the trip in the hole is started a one-step jaw clutch is used to engage the automatic clutch. The automatic clutch drives the rotor of the brake as long as the drum turns in the direction needed for lowering the pipe. When the drum turns in the opposite direction the automatic clutch disengages and rotor remains stationary while the empty block is taken up in the derrick. At the end of the trip the whole drive is disconnected by disengaging the jaw clutch.

Another recent development, pioneered by one of the manufacturers, is to connect the brake to the draw-works shaft through a speedup chain drive. Since, as above stated, the capacity of the brake increases as the cube of speed, it is possible with such an arrangement to use a much smaller brake in comparison to one which would be needed in a direct drive. Satisfactory results have been attained in medium-depth service with 15-in. single rotor hydraulic brake thus connected.

Above practice may represent one of the future trends of development of hydraulic brakes, as the continuously increasing well loads go beyond the capacity of the brakes now commercially available. Another trend would be increase in the size of the rotor since the capacity of a hydraulic brake increases even more rapidly with increase of rotor diameter, than it does with increase in speed.

Devices are now in operation the purpose of which is to make out of hydraulic brake, circulating tank, and all necessary connections a compact, easily movable unit, and to assure easier check on, and regulation of water level in the brake. In one such arrangement a special tank is placed directly at the brake, to asure instant flow of the water from the tank into the brake. Fluid control, standpipe, and a level-indicating dial are placed at the driller's position.

In case of devices of this type certain precautions must be observed if trouble-free operation of the brake is to be attained. Design must be such that the line pressure at the inlet does not exceed 10 lb.; there must be no restriction of the rate of circulation; wide range of control must be available, and ample supply of cool water must be provided for.

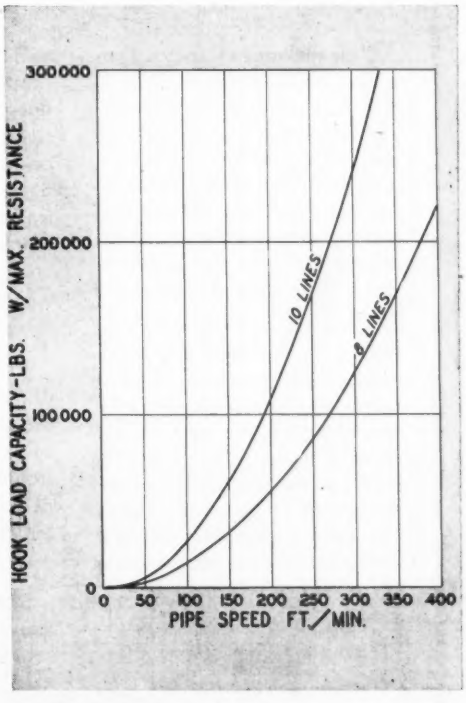

Fig. 20—Load-speed relationship of a 40-in. double-rotor hydraulic brake

No. 18 in a series by Joseph Zaba, petroleum engineer, Houston

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. . . another difficult liquid-storage problem solved with acid- and corrosion-resistant Ampco Metal, long a money-saving favorite with process industries

Wine makers in Caracas, Venezuela, watch costs too. That is why they make their wine-storage tanks out of Ampco Metal, the modern aluminum bronze alloy. Money-saving features are: resistance to acids and corrosion; easy cleaning; neater, more compact installations; and preservation of flavor.

These tanks, 8 feet high and 6 feet in diameter, are fabricated from 3/32-inch Ampco Grade 15 rolled sheet. Welding was done by the carbon-arc process, using ⅛-inch Ampco-Trode 10 aluminum bronze electrodes; these electrodes have the same important acid- and corrosion-resistant properties as the parent metal.

Ampco Metal is an engineered aluminum bronze alloy, available in seven grades for countless applications. Not only does it withstand the destructive action of a wide range of caustics and acids, but it also has a number of desirable service qualities not found in other anti-acid metals: High tensile strength. Good ductility. Less weight. Hard enough to resist squashing, wear, impact, fatigue.

Process industries in all parts of the country are using Ampco Metal to solve a wide variety of problems. Send us your troubles, or call in an Ampco field engineer. Write for latest bulletins giving further details.

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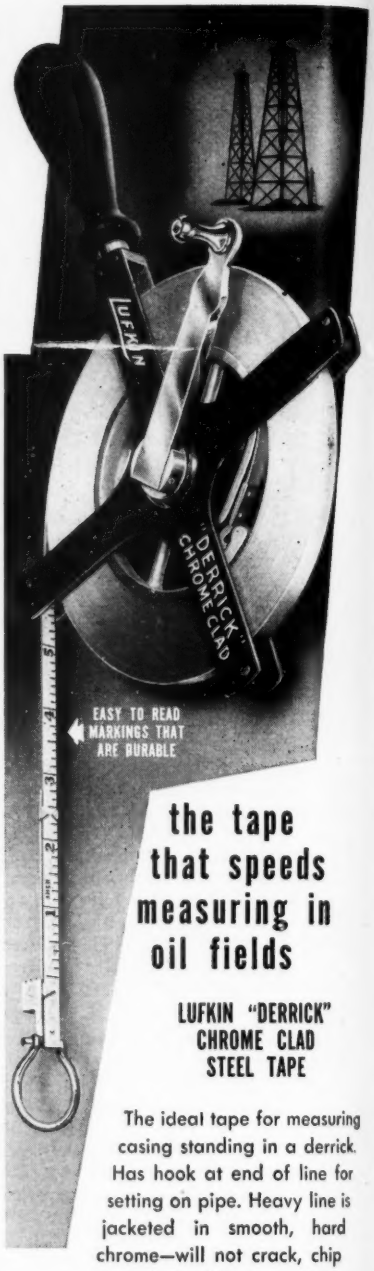

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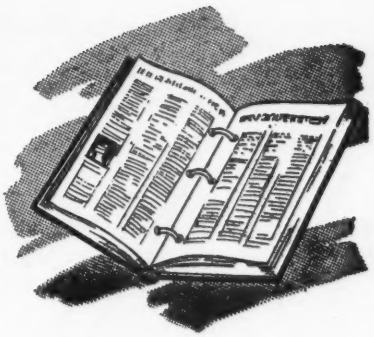
The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Approximate Performance Of Centrifugal Pumps

THE curves shown here indicate the approximate head and power for single-stage centrifugal pumps of either single or double suction. Although the relationships hold reasonably well for standard makes of pumps, they are not recommended except when name plates are missing or adequate performance-characteristic curves cannot be had. When used in connection with The Refiner's Notebook No. 136 (March 22, 1947), the approximate performance curves of a single-stage centrifugal pump can be estimated when only the (1) suction diameter and (2) pressure at closed discharge, are known.

Example.—A pump which has a 3-in.-diameter suction connection and when connected to water and properly primed, produces a head of 140 ft. of water at closed discharge when operating at 1,750 r.p.m. According to The Refiner's Notebook No. 136, it has a capacity of about 245 g.p.m. and should operate at an efficiency of about 66 per cent. According to the chart on this page the feet of head at rated capacity will be approximately 140 ÷ 1.32 or 106 ft. The power at the rated capacity and head is:

$$HP. = \frac{G.P.M. \times \text{ft. head}}{3{,}957 \text{ Eff.}}$$

$$= \frac{245 \times 106}{3{,}957 \times .66} = 10$$

Capacity		Head		Power	
Per cent of rating	Gal. per minute	Per cent of rating	Feet water	Per cent of rating	Hp.
0	0	132	140	54	5.4
10	24	132	140	60	6.0
20	49	132	140	65	6.5
30	73	131	139	71	7.1
40	98	129	137	76	7.6
50	123	127	134	81	8.1
60	147	124	131	86	8.6
70	171	121	128	90	9.0
80	196	116	123	94	9.4
90	220	109	115	98	9.8
100	245	**100**	106	**100**	10.0
110	270	89	94	102	10.2
120	294	75	79	101	10.1

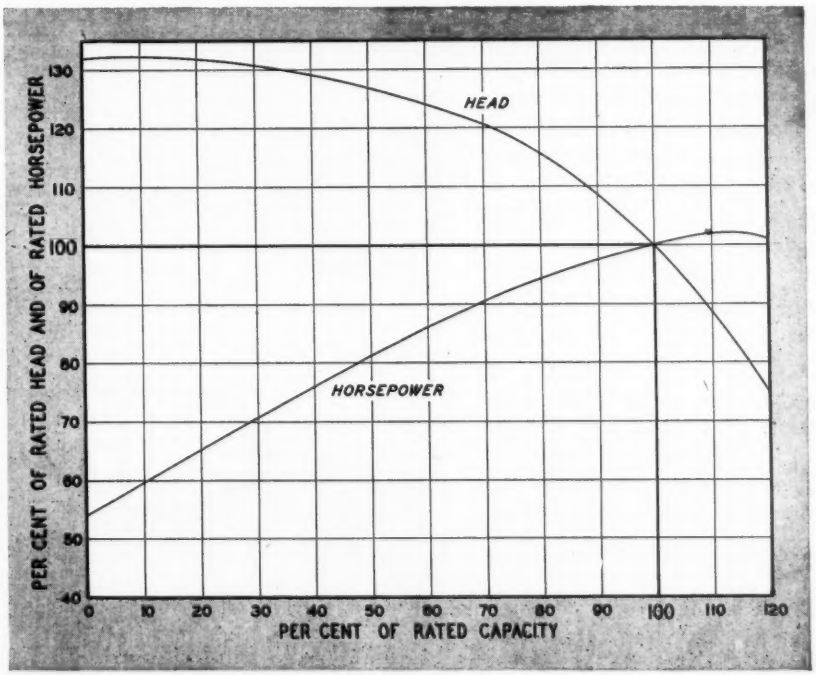


Fig. 1

No. 142 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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ENGINEERING *fundamentals*

No. 284

Case Histories of Mud Acidization

IN relation to what has been said in previous installments on this subject, a few case histories are of interest in bringing out the actual experiences and results of the use of mud acids:

Gas-injection well, Wilcox horizon, Slick sand.—This well is located in the West Tuleta area of Bee County, Texas. Initial cost when completed amounted to $117,000. The well had an open-flow potential of 1,500,000 cu. ft. of gas per day, a surface pressure of 2,400 psi., and a bottom-hole pressure of 2,900 psi. It also produced some distillate. Its completion was very difficult in that many unforeseen things occurred due to salt-water horizons and the squeezing off of the water. It was squeezed and recompleted more than 12 times. During the last squeeze job a surface pressure of 7,200 psi. was used with a mud column of 9.6 lb. per gal. As this well was at a depth of 7,400 ft., the operators had approximately 11,000 psi. of mud pressure against the formation. They were unable to squeeze it on the last operation and had to accept the completion as it was. It was finished with 16 ft. of perforated interval having 124 shot holes.

The well was located in a good structural position to serve as a gas-intake well in the recycling unit of the field. The well was blown down before trying to inject gas and approximately 3 days were required for the well to build up its maximum surface pressure. The line pressure of 3,200 psi. was used in trying to inject gas into the formation, but the well would not take gas. The operators of course did not want to spend $76,000 which would be required to drill and complete a second well in addition to abandoning a well which had already cost them $117,000. Mud acid was thought to be the most logical thing to use in trying to get the well to take gas. Acid was pumped into the well by the use of a typical bradenhead

This article concludes a series of seven installments on "Mud Acidizing" which commenced with article No. 278 in the March 22 issue of the Journal. Starting in the next issue, a number of useful graphs, alignment charts, and fluid-flow curves will be presented through the courtesy of the Southern California Meter Association.

squeeze. The pump pressure to start the acid required 3,500 psi. Approximately 1,000 gal. of acid were pumped into the sand, with a drop in pressure to 2,400 psi. The water was removed from the well by blowing, and gas again put against the formation. The well after this treatment took 700,000 cu. ft. per day. Theoretically, the acid was supposed to have removed approximately 6 in. of the silicates from the well bore back into the formation. However, the acid appeared to have channeled back into the formation and the treatment was somewhat disappointing although of benefit to gas injection.

The operators decided to re-treat with 2,000 gal. of acid. The first 1,000 gal. went in at a pressure of 2,400 psi. With the second 1,000 gal., pressure built up to 3,600 psi. but dropped back to 2,700 psi. during pumping operations. After this acid treatment the well took 1,250,000 cu. ft. per day under the same pressure as before. It was also interesting to find that the well would build up its maximum pressure within a period of 4 hours as compared with the 3 days previously mentioned.

A third treatment of 3,000 gal. was used. The first 2,000 gal. went in at approximately 2,700 psi. The third 1,000 gal. raised the pressure to approximately 3,700 psi. While injecting the last 200 gal. the well broke down to 2,700 psi. and the pump was stopped. The pressure dropped down to 1,500 psi. The well now took 9,000,000 cu. ft. of gas per day at a pressure of 3,050 psi.

The small expenditure of money in the above work was negligible in comparison with the amount that was saved by not drilling another injection well. The acid treatment of this very tight well, the formation of which had a permeability of approximately 5 md., is illustrative of what can be done to at least some wells completed in Wilcox sand horizons.

A pumping well in a Miocene sand section.—This well had been a very good producer but after a length of time had declined to 5 bbl. of oil per day. Production of the well was not profitable and the operators were about to abandon it when the subject of mud acidization was brought up. After reviewing the well data, it was decided to proceed with such work. The tubing was pulled and an acid-soluble scale was noted on the perforations and mud anchor of approximately ¼ in., although the perforations were not stopped up. The well was acidized with 500 gal., cleaned up and returned to production. The amount of oil the well would produce after acidizing was 120 bbl. per day, gradually declining to 70 bbl. per day in an 8-month period. More than 50,000 bbl. of oil were thereafter recovered and it is still producing. In this same South Texas area many wells have been acidized to remove the iron sulfide corrosion supposedly taking place on the screens and perforations in the wells. The production increases range from 100 to 500 bbl. per day. Every well acidized was increased in production and in no case was the percentage of water increased.

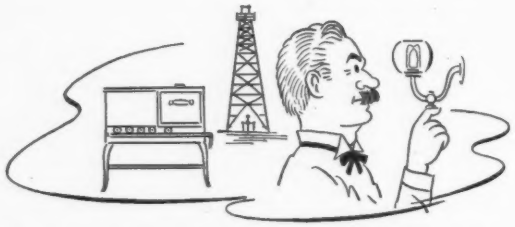
A salt-water-disposal well.—A Gulf Coast well had approximately 100 ft. of perforations in a section of very shaly barren sand. Originally salt water was pumped into this well at a pressure of 50 psi. The surface pressure gradually increased until a pump pressure of 1,700 psi. had to be used, causing the operators to spend considerable money in equipment changes. The well was taking only one-half the rate necessary to dispose of the salt water being produced from the other wells. This well was treated with 2,000 gal. of low-surface-tension acid which is a 15 per cent hydrochloric acid mixture with other chemicals. After acid treatment, the injection pressure was reduced to 50 psi., and would take twice as much water as it originally would at the time of the initial operations.

Series Prepared by Edward N. Jones, consulting engineer, Pettus, Tex.

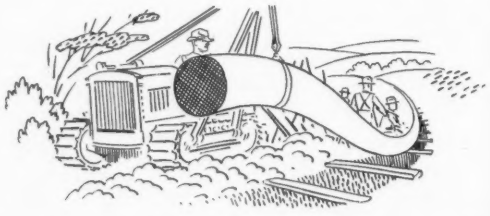
THE STORY OF NATURAL GAS IN OKLAHOMA!

Up through the years, Lady Fortune has laid a favorable hand upon the destiny of Oklahoma. Since 1907, when she was admitted to the Union, Oklahoma has grown from wild Indian territory to the thriving enterprising state it is today.

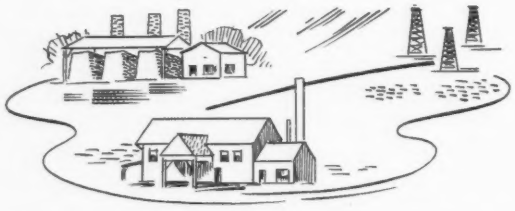
Through these progressive years Oklahoma has been in the extremely fortunate position to offer her people and industries good natural gas service at rates comparable to the lowest in the entire world.



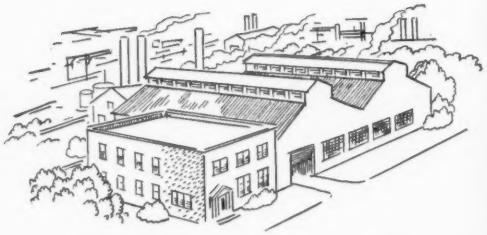
Back in the early days, before Oklahoma became a state, the only people using natural gas were those living close to sources of supply. This was largely due to lack of drilling operations and pipe line facilities.



As the demand for natural gas increased, transmission and distribution problems became more complex. Additional pipe lines had to be laid and interconnected to carry this flexible, universal fuel to every community.



By 1910, natural gas pipe line facilities had been expanded to a point where almost every industry and home in Oklahoma was using natural gas. Industries, large and small, were beginning to realize the many advantages of natural gas over other types of fuel.



Today, industrial customers in Oklahoma find natural gas amazingly economical, flexible, efficient and easy to use in manufacturing processes and in production and drilling operations.

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REFINING

Monsanto Makes Plans to Rebuild in Texas City

MONSANTO CHEMICAL CO. has begun the clearing of wreckage preparatory to the rebuilding of its almost-demolished Texas City, Tex., styrene plant.

In St. Louis, William M. Rand, Monsanto president, said parts of the plant may be back in production in 6 months, though complete rebuilding with no delays in receiving materials will require 18 months. Meanwhile, Monsanto is seeking unused wartime styrene facilities to operate on a temporary basis.

Pan American Refining Corp.'s Texas City refinery of 100,000 bbl. daily crude capacity was back on its regular schedule the middle of last week. This plant suffered no serious damage in the disastrous April 16 explosion and fires which followed when a shipload of ammonium nitrate exploded in the bay.

Property losses of other oil companies with refineries in the area, including Republic Oil Refining Co., Humble Oil & Refining Co., and Sid Richardson Refining Co., consisted largely of tankage, docks, loading lines, and other auxiliary facilities.

In Washington, an official of the chemical and drugs division of the Commerce Department's Office of International Trade said the loss in chemical production as a result of the Texas City disaster will not be as heavy as first reports indicated.

Chief loss is in styrene which was produced by Monsanto. During the war Monsanto operated this plant as an agent for Rubber Reserve; last year it bought the property for $9,500,000. Design capacity was 50,000 short tons annually; original cost, approximately $18,291,000.

Although this plant represented some 27 per cent of the war-built styrene capacity, production will still be about 208,000 tons this year, it was estimated in Washington. Of this, about 137,500 will be required for synthetic rubber, leaving 70,500 tons for resins against an actual 1946 consumption of styrene in resins of 33,400 tons.

Monsanto announced its directors had appropriated $500,000 for relief among its Texas City employes, to be paid over and above its legal liabilities. Monsanto also is paying $1,000 to each widow or real dependent, and the group-insurance payment for workers at the average hourly rate was placed at between $6,000 and $8,000 each. A Monsanto announcement pointed out each widow or beneficiary in addition would receive $20 a week for 360 weeks, or $7,200, under Texas law.

Socony-Vacuum Announces New Cutting-Oil Additive

Lubrication engineers and research experts of Socony-Vacuum Oil Co., Inc., have announced the development of a new cutting-oil additive which entirely replaces sulfurized fatty materials in fluids for machining carbon and alloy steels.

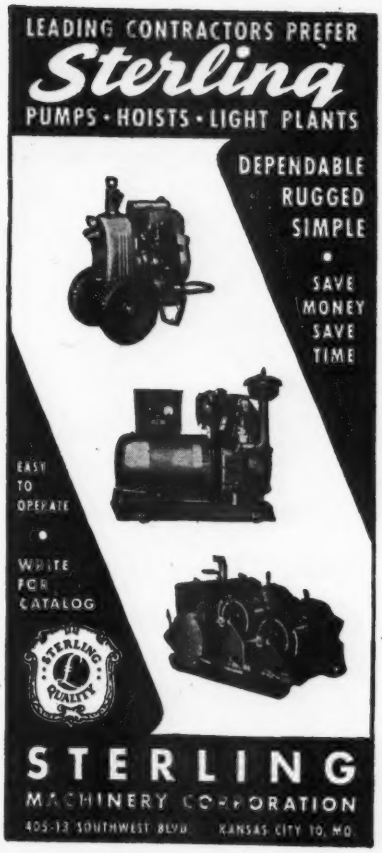
The additive is being used instead of the sulfurized fatty materials, in 18 grades of Socony-Vacuum's "Sultran" line of cutting oils. Development of the additive was undertaken in the company's laboratory at Paulsboro, N. J., in search of an answer to scarcity and costs of lard oil and other fatty materials.

Tests showed, Socony-Vacuum officials said, that the additive is even more suitable than its predecessors in increasing the oiliness of the basic cutting fluid. Cutting oil with the additive was described as having light color, transparency, total lack of odor, and higher cutting efficiency. Other advantages are elimination of gumming and any possibility of rancidity, as well as a safeguard against the dermatitis which sometimes results from machine operators' contact with cutting fluids containing fatty oils, it was said.

Imperial Defers Some Construction Projects

Because of the shortages of building materials, construction of additions to the research laboratory at Sarnia, Ont., and of a refinery laboratory at Calgary, Alta., has been deferred, Imperial Oil, Ltd., reported in the company's annual report.

Reviewing various company plans for 1947, the company said new asphalt manufacturing facilities are being considered for the refinery at Regina, Sask. A study is being made of the use of crude oil from the Lloydminster area for the production of asphalt. The refinery construction program at Montreal East, Que., where a Fluid catalytic-cracking unit and other facilities are be-



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ing built, is proceeding satisfactorily, the report noted, and a plant for regeneration of synthetic catalyst is planned for construction at Sarnia in 1947.

Bay Petroleum to Build McPherson Reformer Unit

Bay Petroleum Corp., Denver, has announced the signing of a contract with Refinery Engineering Co., Chicago, for the construction of a 1,000-bbl. reformer unit at its McPherson, Kans., refinery.

The U.O.P. polymer unit, built during the war for the production of high-octane codimer, has been revamped and enlarged by company engineers to increase the amount of high-octane gasoline produced from the reformer unit, according to C. O. Garbrecht, general superintendent.

The company is building similar units at its Denver refinery under the supervision of company engineers, to supply high-octane gasolines.

The design and engineering is being done by Universal Oil Products Co., Chicago.

Premier Asks Approval of Multiple-Car Proposal

FORT WORTH.—Premier Oil Refining Co. last week followed the precedent set by Cosden Petroleum Corp. in asking the Texas Railroad Commission to approve rates for multiple-car shipments of petroleum products by rail from its Chautauqua plant in West Texas to its Fort Worth refinery.

The proposal calls for a rate of 6.5 cents per 100 lb. under the same conditions now in effect between Cosden and Texas & Pacific Railroad. *(For details of the commission's order on Cosden's application see The Oil and Gas Journal, January 4, page 24).*

Viscous-Neutral Output Shows February Increase

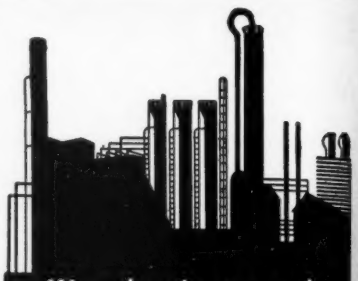
Production of viscous neutrals by 13 Mid-Continent refineries jumped from 322,711 bbl. in January to 468,669 bbl. in February, according to figures released by the Western Petroleum Refiners Association.

Production of bright stocks dropped from 236,652 bbl. to 227,564 bbl. in February, but paraffin oils, steam refined stock, and blended oils all showed increases over the previous month.

Panhandle Plant Shut Down Because of Crude Shortage

Panhandle Refining Co. last week was reported to have shut down its 4,000-bbl. skimming and cracking plant at Wichita Falls, Tex., due to crude-oil shortage. Panhandle's 1,500-bbl. plant at Lueders, Tex., was reported not affected by the shutdown.

The Wichita Falls plant had been receiving between 800-1,000 bbl. of crude oil daily through The Texas Co. and Sinclair Prairie Pipe Line Co.'s lines, with the balance coming from Continental Oil Co.



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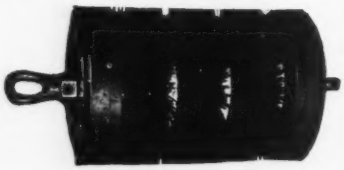

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PIPE LINES

Magnolia Lets Contracts For 650-Mile 20-In. Line

Magnolia Pipe Line Co. has awarded contracts for the laying of the 650-mile 20-in. crude-oil line from Corsicana, Tex., to Patoka, Ill., as follows: Section 1, extending 109 miles from Corsicana, let to Oklahoma Contracting Co.; Section 2, 108 miles, Eastern Construction Co.; Section 3, 111 miles to Conway, Ark., H. C. Price Co.; Sections 4, 5, and 6, totaling 332 miles, Oklahoma Contracting Co.

A field office will be established at Texarkana, Ark., which will be the headquarters of J. E. McGeath, assistant general superintendent. Later this office may be moved to Little Rock. Pipe is expected to start arriving May 20. Work on the four stations, including the initial one at Corsicana, will start soon. Of these three will be electric driven; possibly one will have diesel power. The project will be completed early in 1948.

Phillips Awards Coating Contract for Products Line

Phillips Petroleum Co. awarded the contract to H. C. Price Co. for supplying and applying Somastic coating on the McKee, Tex.-La Junta section of the Borger, Tex.-Denver 6-in. products line, for which the general contractor is Harry C. Lyles. Pipe will be coated at the following rail points: Stratford, Tex.; Boise City, Okla.; and Pritchett, Colo. William Bauer, superintendent, will be in charge of the coating operations for H. C. Price Co.

For carrying on the work contracted last week for laying a 121-mile section (Texas-Arkansas state boundary to Conway, Ark.) of Magnolia Pipe Line Co.'s 20-in. 650-mile Corsicana-Patoka, Ill., crude oil line, H. C. Price Co. has tentative plans for establishing headquarters at Hot Springs, Ark.

Utah Plans 200-Mile 10-In. Rangely-Salt Lake Line

Utah Oil Refining Co. will construct a 200-mile 10-in. crude-oil pipe line from the Rangely, Colo., field to the company's refinery at Salt Lake City, Utah, according to an announcement by E. S. Holt, president. Construction will be completed in 1948 to provide daily transportation capacity of 24,500 bbl.

Pipe laying will start in May 1948 on the new line to follow a route which will be as direct as practicable over very mountainous and rugged terrain. In commenting on the undertaking to be conducted under the supervision of Stanolind Pipe Line Co., several aspects were pointed out by Bruce C. Clardy, president. The building of the proposed Utah line will mean the abandonment of plans announced last November for a Rangely-Wamsutter 12-in. line to be built by Stanolind to connect with Utah's Fort Laramie-Salt Lake City crude oil line. If the previous plan had been followed, much looping of the Wamsutter-Salt Lake City section would have been required to increase capacity from the current one of 22,000 bbl. daily. More pipe would have been required than for the direct Rangely-Salt Lake City project. Furthermore, the latter will have only one intermediate pump station, thus avoiding pumping through seven stations in the Wamsutter route set-up.

The proposed line becomes necessary because of the rapid increase in demand in the Salt Lake City territory. Two Stanolind engineers are making a reconnaissance survey to get data for determining the route and the power resources of the area.

Warterfield Is Consultant For French Products Lines

Floyd E. Warterfield, Jr., president, Oklahoma Engineering Co., Dallas, has been appointed engineering consultant by the French Government in the planning of refined-products pipe lines which are to be built as joint ventures in which private oil companies, the French Government and transportation interests will participate.

Planning for French pipe-line projects is well advanced, according to reports. Warterfield is engaged in engineering for the project during his current trip to France from which he is expected to return to the United States at the end of May.

A decision has been reached to proceed with construction of the first project of the program which will consist of a products line connecting refineries in northern France with the Le Havre area and extending 140 miles to the environs of Paris. Con-

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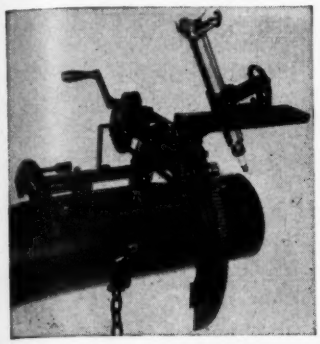

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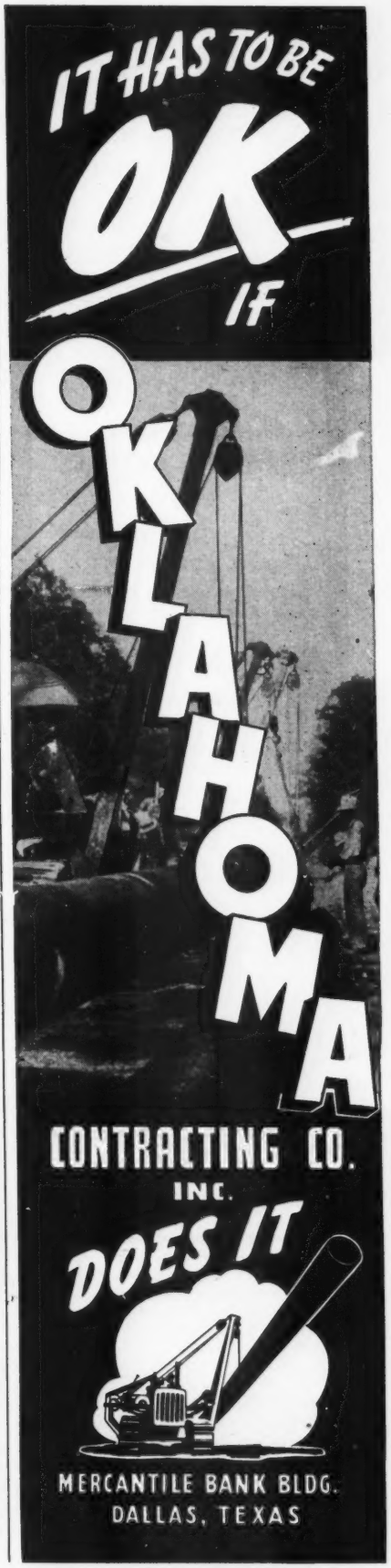
struction is estimated to cost 700,000,000 francs and to require 12,000 tons of steel. The Le Havre-Paris line will transport 150,000 tons of products annually, according to reports, at a cost of 80 francs per ton which will effect a considerable saving over the current cost of 150 francs per ton by rail. The pipe line would also contribute to relieving river-barge congestion. Consideration is also being given to laying a second pipe line in the Toulouse area.

The company planned for undertaking the construction and operation of the Le Havre-Paris project is organized according to a scheme which would serve as a pattern for further joint ventures of this kind required by French economy.

The French Government would be a minority stockholder in the pipeline organization, according to reports. Oil companies are said to have 50 per cent of the stock. The other 50 per cent is for the government, railroads and barge operators scheduled to participate in the undertaking.

Six American oil companies currently importing and marketing the bulk of petroleum for France include: Standard Oil Co. (N. J.), Socony-Vacuum Oil Co., Inc., California-Texas Oil Co., Ltd., Gulf Oil Corp., Atlantic Refining Co., and Sinclair Oil Corp. A number of other companies share in the French petroleum trade. Other organizations engaged

Guy S. Connors, vice president, Williams Brothers Corp., leaving Tulsa for Ohio and West Virginia pipe-line construction projects in the company's Beechcraft Model S-18 twin-engine airplane flying 200 m.p.h. with space for five passengers in addition to the pilot and copilot. In addition to this plane which contacts operations in the United States, the company has a plane of the same type in South America to serve A. M. Garber, superintendent



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in the petroleum industry in France include Iraq Petroleum Co., Ltd., Anglo-Iranian Oil Co., Ltd., and Shell groups.

Deliveries From Pipe Lines Increase 4.6 Per Cent

Motor fuel delivered from pipe lines in January totaled 16,307,000 bbl., as compared with 15,593,000 bbl. in January 1946, an increase of 4.6 per cent. It also compared with 17,749,000 bbl. in December, a decrease of 8.1 per cent.

Motor fuel turned into lines in January totaled 17,363,000 bbl., as compared with 14,317,000 bbl. in the year-earlier month, an increase of 21.2 per cent. The December total was 18,742,000 bbl. representing a decrease of 7.3 per cent.

Stocks in lines and working tanks at the end of January amounted to 10,149,000 bbl., against 9,260,000 bbl. a month earlier and 9,290,000 bbl. a year earlier.

Calculations from Bureau of Mines statistics indicated that the volume of motor fuel turned into lines was 26.3 per cent in January, based on total motor-fuel production of 65,985,000 bbl. in the month. It compared with 23 per cent in January 1946.

United Natural to Install Company Radio System

United Natural Gas Co. has been granted permission by the Federal Communication Commission to install a radio communication system for use in the northwestern Pennsylvania area in which the company operates.

Known as frequency-modulated radio, the company's system will operate on a frequency of 33,020 kc which is beyond the range of the ordinary broadcast receiver.

Plans call for the installation of fixed transmitters to be located in Oil City, Hendersville, Sigel, Mount Jewett, and Lewis Run. In addition to the fixed stations, approximately 25 two-way radio sets will be installed in automobiles. When completely installed, the system will be operated in conjunction with the company's present telegraph and telephone communications for gas-dispatching purposes and emergencies.

At its Oil City office, U.N.G. maintains a gas-dispatching center. From gas-pressure reports sent hourly to the central office and from weather-temperature reports received there at regular intervals, gas dispatchers are fully informed as to operating requirements and are better able to control gas pressure in the various parts of the company's pipe-line system.

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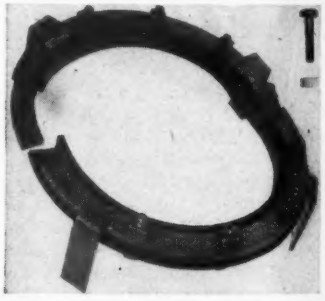

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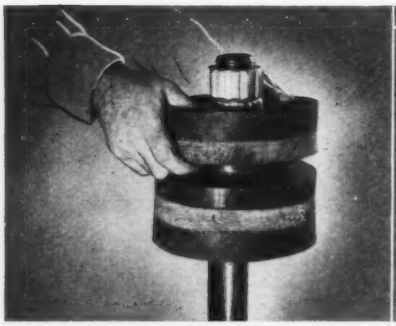
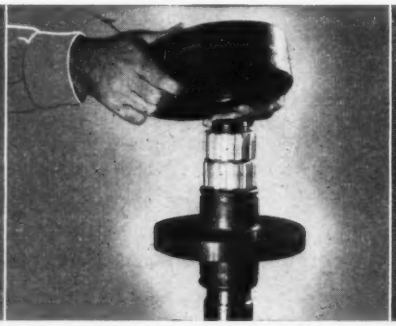


When the rubbers are worn, simply remove the old rubbers and save the piston body.



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NATURAL GAS

New Firm Takes Over Tennessee Project

WASHINGTON. — East Tennessee Natural Gas Co., Chattanooga, has requested Federal Power Commission authorization to construct and operate facilities for deliveries of natural gas at the city gates of Chattanooga and Knoxville, Tenn., and surrounding areas and also to make a limited number of direct industrial sales. Construction is planned to be completed during 1948.

East Tennessee Natural told FPC it has been recently incorporated as a successor in interest to Tennessee Natural Gas Lines, Inc., in a similar project for which an application was filed with FPC. Tennessee Natural Gas Lines has transferred to the new company all rights including its gas supply contract with Tennessee Gas & Transmission Co.

Project plans comprise construction of approximately 186½ miles of 16-in. transmission line extending from a point to take off from the lines of T. G. & T. about 5 miles northeast of Lobelville, Tenn., to the Chickamauga Dam near Chattanooga, and about 112 miles of 12¾-in. line from Chickamauga Dam to the city limits of Knoxville. Laterals aggregating approximately 246 miles would be constructed. The 43 communities would be served. None of the markets is now receiving natural gas.

East Tennessee Natural said in its application it assumes Chattanooga Gas Co. will become a city-gate customer, notwithstanding that it is a wholly owned subsidiary of Southern Natural Gas Co., which also seeks to serve the Chattanooga market.

Temporary Authorization Given United Fuel Project

WASHINGTON.—The Federal Power Commission has granted temporary authorization to United Fuel Gas Co. to construct and operate about 70 miles of 20-in. transmission pipe line and auxiliary facilities in West Virginia at a cost of approximately $2,970,000.

The installation will complete a single high-pressure transmission line extending from the Cobb compressor station, Roane County, West Virginia, to a connection with a line of Manufacturers Light & Heat Co. in Monongalia County, West Virginia, and will enable the company to increase gas deliveries to the Pittsburgh group of Columbia Gas & Electric Corp.

The temporary authorization was granted to allow the company to begin construction of the line immediately so that it can be completed by June 1 in order that gas may be delivered for storage this summer. Deliveries to storage are necessary, the company said, to meet peak demands during the 1947-48 winter months.

Alberta Natural-Gas Service to Be Extended

LETHBRIDGE, Alta.—P. D. Mellon, vice president of Canadian Western Natural Gas, Light, Heat & Power Co., Calgary, has announced that the company will extend its gas services in Lethbridge and Taber, Alta. Transmission lines also will be extended to Coaldale and Barnwell, Alta., conditional on obtaining materials.

To meet heavy demand of the past winter, it was necessary to withdraw gas from the Bow Island fields, which normally are held in reserve. As a result of repressuring Bow Island field with gas from Turner Valley, the company has stored some 13,000,000,000 cu. ft. of gas and expects to build its reserve there up to 20,000,000 cu. ft. in another 5 years.

Company Asks to Refuse New Commercial Users

Gas Service Co. has filed a request with the Missouri, Kansas, and Oklahoma public-service regulatory commissions asking that the company be permitted to refuse service to new commercial customers for building heating throughout the entire area it serves.

Ben C. Adams, president, said the action would be only temporary, prevailing only until Cities Service Gas Co., the pipe-line company, is able to provide facilities to bring additional gas into the distribution area. Adams said the move was made to assure an adequate supply of gas for the company's present domestic customers, whose service will not be curtailed.

FPC Vacates Suspension Of Colorado Agreement

WASHINGTON.—The Federal Power Commission has vacated an order of April 9 suspending a rate schedule setting forth conditions of service for gas sold to Public Service Co. of Colorado by Colorado Interstate Gas Co.

The schedule is in the form of an agreement between Colorado Interstate and the Public Service Co. and provides that the latter shall take from Colorado Interstate for a period of 20 years, subject to certain qualifications, the entire amount of gas required to supply its consumers now or hereafter connected to its distribution facilities. No changes in the present rates are proposed, according to an FPC announcement. The proposed conditions of service will become effective April 20, 1947.

Natural Gasoline

Buchanan Building Plant Near Magnolia, Ark.

D. E. Buchanan, formerly head of Hanlon-Buchanan, Inc., is building a natural-gasoline plant near Magnolia, Ark., to process some 12,000,000 cu. ft. of natural gas, yielding probably 35,000 gal. per day of natural gasoline.

The plant is engineered by Petroleum Engineering, Inc., of Houston and Tulsa, and is being constructed by Refinery Maintenance Co., of Los Angeles, under the direction of H. M. Nelly, formerly with J. F. Pritchard & Co.

January Natural-Gasoline Production Sets Record

Production of natural gasoline and allied products during January reached a total of 447,378,000 gal. to set a new record, the Bureau of Mines monthly report shows.

Separating for the first time the production totals of conventional natural-gasoline plants from those of cycling plants, the January report listed output of these two operations at 323,726,000 gal. and 123,652,000 gal., respectively.

The bureau noted that production increased in all states except Kentucky, Oklahoma, Montana, and New Mexico. Production totals included: Texas 137,464,000 gal, Louisiana 15,653,000 gal., California 70,450,000 gal., and Oklahoma 36,609,000 gal.

During the 31 days of January, stocks at plants and terminals fell from 146,503,000 gal. to 142,906,000 gal., and at refineries, from 62,706,000 gal. to 58,422,000 gal.

In a breakdown of production by type of light product, the bureau reported liquefied-petroleum gases production gained 25 per cent over January 1946 in response to growing demands. Natural-gasoline production declined 3 per cent at the same time.

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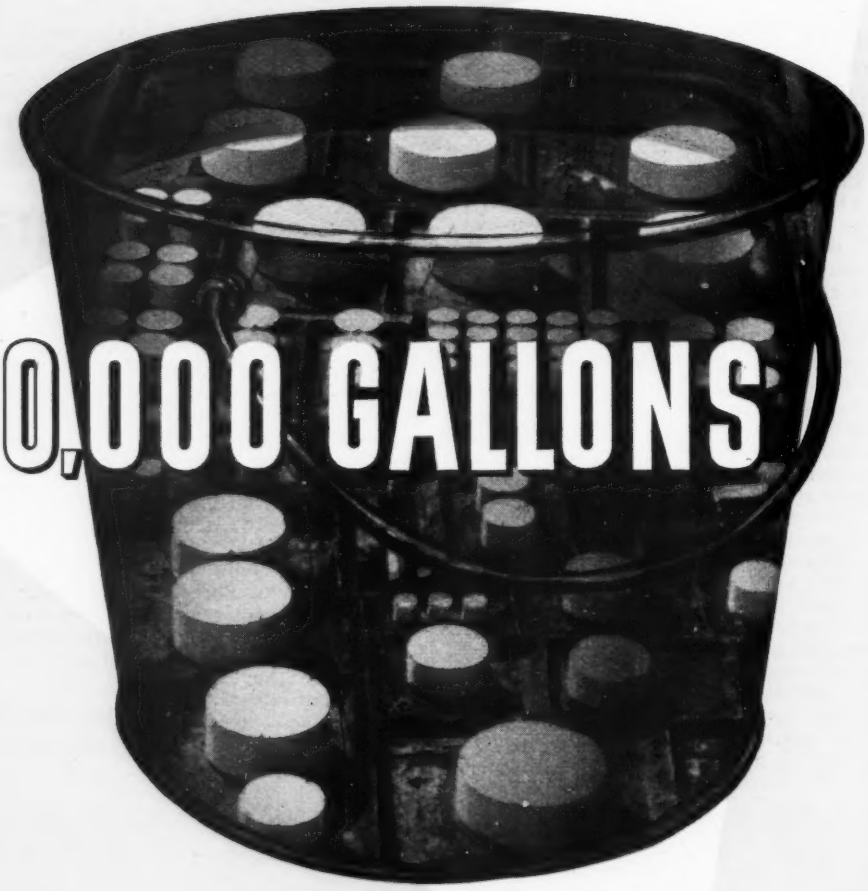

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Exploration and Drilling

New E. Texas Condensate Discovery

STANDARD OIL CO. OF TEXAS appears to have made an important gas-condensate strike in Cherokee County, Texas, in its 1 New Birmingham Development Co., 8 miles southwest of Jackson, being rated by the company as having an open-flow capacity of from 147,000,000 to 170,000,000 cu. ft., with a potential of 500 bbl. of condensate per day on open-flow basis. Production is from perforations opposite the Rodessa zone of the Glenrose limestone at 8,608-30 ft., and 8,638-52 ft. Derrick floor elevation is 478 ft.

Exact location is 567 ft. east of the easterly west line, and 467 ft. south of the northerly north line of Tract 2 of the G. F. Looney Survey. The drilling contractors, Trant-Phillips, spudded September 7, 1946, completed drilling to 10,015 ft., total depth, datum —9,537 ft. on December 19, 1946. Testing has been going on since, and the completion date is given as April 24, 1947. Casing record is 20-in. at 56 ft., 13⅜-in. at 588 ft., 9⅝-in. at 5,807 ft., 5½-in. at 10,015 ft., total depth; plugged back to 8,656 ft.

Datum tops given are Massive Anhydrite —7,924 ft., Base Massive Anhydrite —8,072 ft., top James limestone —8,586 ft., top Pettit —8,783 ft., top of Travis Peak —9,128 ft. Datum intervals on perforations through which well is producing are —8,130 to 52 ft., and —8,160 to 74 ft. Datum on plugged-back total depth is —8,178 ft. Production packer, Baker Model "D," is set at 8,560 ft., about 10 ft. below the base of the Massive Anhydrite. Testing has been through 2-in. tubing.

Possible gas and oil pays in the James and Pettit limes, and in Travis Peak sands, were tested but proved nonproductive and were squeezed off. No cores of the Upper Rodessa lime were obtained, but cutting samples showed a small amount of visual porosity. After acidizing with 5,000 gal., the gas flow was substantially increased.

The company states the test is located on a deep-seated zone, which was discovered by subsurface study and seismograph surveys. The discoverer holds a block of about 20,000 acres on the structure.

Shutin bottom-hole pressure is given as 4,223 psi., with 3,558 psi. on the tubing. Official data are, 3,340,000 cu. ft. through 3/16-in. choke, with 4,111-psi. bottom-hole flowing pressure, 3,445 psi. on tubing; 4,800,000 cu. ft. through 15/64-in. choke, with 4,071-psi. bottom-hole flowing pressure and 3,349 psi. on tubing; and 6,550,000 cu. ft. through 5/16-in. choke, with 4,035-psi. bottom-hole flowing pressure and 3,068 psi. on tubing.

SOUTH LOUISIANA

Delta Duck Field Gets ¼-Mile South Extension

NEW ORLEANS.—The Texas Co. 20 State-Delta Duck Club Unit, ¼ mile south offset to production in the Delta Duck field, 6-21s-20e, Plaquemines Parish, has been completed for a potential of 195 bbl. of 35.9°-gravity oil daily through a 9/64-in. choke, with 1,300 psi. flowing pressure on the tubing and a gas-oil ratio of 600 cu. ft. Production is through perforations at 8,184-48 ft. Total depth is 9,808 ft. in salt.

At Venice pool, Plaquemines Parish, Tide Water Associated Oil Co. 2-D Manhattan Land & Fruit Co., 22-21s-30e, was completed for a potential gage of 333 bbl. of oil per day through a 10/64-in. choke, gas-oil ratio 1,072 cu. ft., TP 2,100 psi., gravity 30.2°. Production is from the deep horizons with perforations at 11,565-595 ft.; total depth is 11,812 ft.

Falcon Seaboard Drilling Co. et al are ready to drill an 11,500-ft. exploratory test in the Bayou Platten area of Assumption Parish. The 1 Williams Cypress is located in the SW NE 39-14s-14e, 7 miles east of production in the West Lake Verret field and ¾ mile southwest of Barnsdall Oil Co. 1 Williams Cypress, an 8,154-ft. dry hole.

The Texas Co. 1 Lafourche Basin Levee District, wildcat test 1¼ miles west of the No. 1 State, gas well in the Queen Bess Island field of Jefferson Parish, has 8⅝-in. protection cemented in the hole at 12,004 ft. Operators continue to drill below 14,174 ft. in hard shale and lime.

Sun Oil Co. will start operations soon in another 11,500-ft. wildcat test of the Kenilworth area, St. Bernard Parish. The new test, 2 Robinson Estate, is located in Section 78-14s-14e. The No. 1 Robinson Estate was drilled last year to a total depth of 11,502 ft. with no favorable shows.

The California Co. 2 Louisiana Citrus Lands, Inc., in the Alliance pool was completed for an initial production of 70 bbl. of oil per day through a 7/64-in. choke, gas-oil ratio 1,886 cu. ft., tubing pressure 1,800 psi., gravity 39.7°. Total depth is 10,336 ft. Production is through perforations at 9,700-30 ft.

There were 13 new locations reported this week with only two new wildcat starts, one each in Iberia and St. Bernard parishes. Total completions were five oil, one condensate and three dry, with Plaquemines Parish receiving the greatest activity, reporting three oil wells in proven fields. Two wildcats completed were dry, one each in Jefferson Davis and St. Charles parishes.

SOUTH LOUISIANA WILDCAT FAILURES

Jefferson Davis Parish: Shell Oil Co., Inc., 1 Long Bell Pet. Co., Inc., 33-7s-7w, 4 mi. W of Indian Village field, dry, TD 8,731 ft. in sidetracked hole.

St. Charles Parish: Union Oil Co. of Calif. 1 Geo. Montgomery, 85-12s-19e, 3 mi. westerly from Hahnville discovery well, dry, TD 10,985 ft.

EASTERN TEXAS

New Distillate Field For Cherokee County

DALLAS.—Standard Oil Co. of Texas 1 New Birmingham, 5 miles south and slightly east of Ironton, Cherokee County, according to company announcement, is estimated good for 170,000,000 cu. ft. open flow, and 500 bbl. of condensate, reservoir pressure 4,223 psi., from perforations in the Rodessa zone of the Glenrose at 8,608-52 ft.

In Panola County, 3½ miles east of production, Continental Oil Co. 1-B Louis Werner Sawmill Co., 2 miles southeast of Deadwood, made a drill-stem test in the Gloyd at 5,167-75 ft. Using ¼-in. chokes, top and bottom, gas came to the surface in 5 minutes. In 12 minutes the recovery was 600 ft. of fluid, composed of 50 ft. of oil and gas-cut mud, 100 ft. of green oil of an estimated 40°-gravity, and 450 ft. of salt water. Bottom-hole flowing pressure was 688 psi., and shut-in pressure rose to 2,632 psi.

The two Harrison County discoveries continued testing on last report. Ten miles east of Marshall, Arkansas Fuel Co. 1 M. C. McCauley flowed at the rate of 49 bbl. of oil a day through 10/64-in. choke. Flowing pressure on tubing was 650 psi. and 900 psi. on the casing. Operators planned to change to ¼-in. chokes for further tests. E. C. Johnson 1 Edna Hood, 10 miles southeast of Marshall, kicked off and flowed after running the swab 30 times. Recovery was a small amount of gas and distillate from the lower Pettit at 6,160-80 ft., and from the Travis Peak at 6,276-94 and 6,410-75 ft.

The Texas Co. 1 W. M. White, deep test in the Fairfield gas field of Freestone County, was drilling below 14,238 ft. in limestone. In San Augustine County, 3¾ miles north of San Augustine, M. E. Davis et al 1 W. A. Johnson was below 7,832 ft. in limestone and shale after running electric log to 7,600 ft. In Smith County, 5 miles northeast of Starrville, Bobby Manziel was reported moving in rotary to clean out and test the 1 J. L. Morrison, S. J. Lott Survey A-575. This was a Paluxy failure in 1945, with total depth at 8,110 ft. in Travis Peak sand, plugged back to 8,016 ft.

EAST TEXAS SUCCESSFUL WILDCAT

Leon County: Harvey Oil Co. 1 C. E.

Powell, J. Scritchfield Sur., 3 mi. SE Flynn, pumped 30 bbl. 35°-gravity oil in 6 hours, TD 7,484 ft.

EAST TEXAS WILDCAT FAILURE

Cherokee County: Delta Drilling Co. et al 1 Frances Lester, John H. Russell Sur., 3 mi. NW Ponta, dry, TD 9,295 ft., sample tops: Pecan 3,280 ft., Austin 4,175 ft., Woodbine 4,340 ft., Paluxy 5,910 ft., upper Glen Rose 6,150 ft., Massive 7,705-7,950 ft., James 8,446 ft., Travis Peak 9,030 ft., no shows, elev. 320 ft.

Collin County: Humble Oil & Ref. Co. 1 J. W. Wester, A. J. Culwell Sur. A-209, 3 mi. S Weston, dry, TD 7,850 ft., Ellenburger 6,830 ft., no shows, may deepen to 8,500 ft.

Grayson County: Farris, Carter & McCamey 1 J. L. Schindler, Peter Glass Sur., 2 mi. NE Pilot Point, dry, TD 3,312 ft., top Pennsylvanian 1,815 ft., show oil 3,171 ft.

SOUTHWEST TEXAS

Webb County Gets New Shallow Gas Field

CORPUS CHRISTI.—Hickok & Reynolds 1 Amado Perez et al, new shallow gas discovery just northeast of the Volpe field in Webb County, flowed 1,600,000 cu. ft. of gas per day through a 3/8-in. choke, with 498 psi. shut-in pressure. Production is through perforations at 1,266-76 ft. Total depth is 2,631 ft. Electrical log indicated gas sand at 1,265-95 ft. The 5½-in. casing was set to 1,328 ft. for the completion.

Skelly Oil Co. 1 W. C. Rivers, wildcat approximately 1½ miles southeast of Agua Dulce townsite, and 1½ miles west of Agua Dulce field, in western Nueces County, is producing approximately 18 bbl. of oil per day on gas lift after installing flow valves for completion through perforations at 5,992-6,000 ft. The well previously had flowed oil and salt water from this sand section and a total of 10 squeeze jobs have been made on this section trying to get a good cement job. This well is located in Lot 6, Section 26, Benton Pasture subdivision.

Pan American Production Co. and Jack Little, Tr., 1 Loruth Smith Rivers, 1 mile west of Agua Dulce townsite and 2½ miles south of Richard King field in Nueces County, has been completed as a gas well through perforations at 5,528-39 ft., and shut in without gage; shut-in pressure 2,100 psi. Several attempts were made to complete for oil production in the 6,000-ft. sand, but all obtained only salt water with a small cut of oil. Total depth is 6,316 ft., with 5½-in. casing set at 6,031 ft.

Two more new oil pays for the east flank of the La Gloria field, in Jim Wells County, have been opened by Republic Natural Gas Co. 2-A Charles L. Scott, Tr., in the southwest corner of Lot 9, Block 4, subdivision of lands adjoining townsite of La Gloria. Drilled to a total depth of 6,690 ft., this well was dual-completed through perforations at 6,598-6,604 ft., with initial production of 109 bbl. of 39.5°-gravity oil; and through perforations at 6,373-80 ft., where drill-stem test open 22 hours flowed oil under 1,200 psi. working pressure. Top of the lower sand was 6,598 ft.

Mid-Continent Petroleum Corp. 1 John Sommer, wildcat test 1½ miles south of the Agua Dulce townsite in western Nueces County, flowed 112 bbl. of oil and 30 bbl. of salt water per day through a 3/16-in. choke, on initial production test through perforations at 5,982-88 ft. Tubing pressure was 450 psi. and casing 930 psi. Total depth is 7,008 ft., with 5½-in. casing set at 6,095 ft. for the completion attempt. This well is located in Section 24, Benton Pasture subdivision, 2½ miles west of Agua Dulce field and 3 miles north of the Stratton field.

There were 25 new locations reported this week with 4 being wildcat starts, 1 each in Duval, Medina, Milam and Webb counties. Total completions were 18 oil, 1 gas, and 12 dry holes, with 8 of the dry holes being wildcats, 1 each in Duval, Gillespie, LaSalle, Milam, San Patricio, Starr, Webb and Willacy counties. Two new oil pays were opened in proven fields, one each in West Sinton field, San Patricio County and Davenport field in Starr County.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

San Patricio County: New oil pay, West Sinton field—Jones & Morgan 3 A. Loy Sims, on Block 15, F. J. Welder Subd., M. J. de la Garza Grant, top pay 5,130 ft., TD 5,186 ft., perf. 5,136-42 ft.. IP: 181 bbl. net oil per day through ¼-in. choke, gas-oil ratio 663, TP 450 psi., CP 1,565 psi., gravity 36.4°, 74.2 per cent water.

Starr County: New oil pay, Davenport pool—Dee Davenport 2 Davenport-State, Sur. 974, 2,300 ft. N NE of 1 Davenport-State gas discovery well, and 2 mi. N of Frost field, 13 mil. NW of Sullivan City, top pay 4,172 ft., TD 4,205 ft., perf. 4,182-92 ft., IP: 146 bbl. oil per day through 9/64-in. choke, TP 400 psi., CP 1,200 psi., gravity 48.9°, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Duval County: Bridwell Oil Co. 2 A. G. Villareal in San Andres Grant, 3½ mi. SE of Benavides, dry, TD 5,036 ft.

Gillespie County: L. Underwood Rowntree 1 Richard Knott, Sur. 154, 8 mi. E of Harper, deepening job, old TD 700 ft., dry, TD 3,190 ft. in granite.

LaSalle County: Arkansas Fuel Oil Co. 1 H. W. Tatum, I&GN Sur. 35, Blk. 5, 12 mi. NW of Cotulla, dry, TD 8,102 ft.

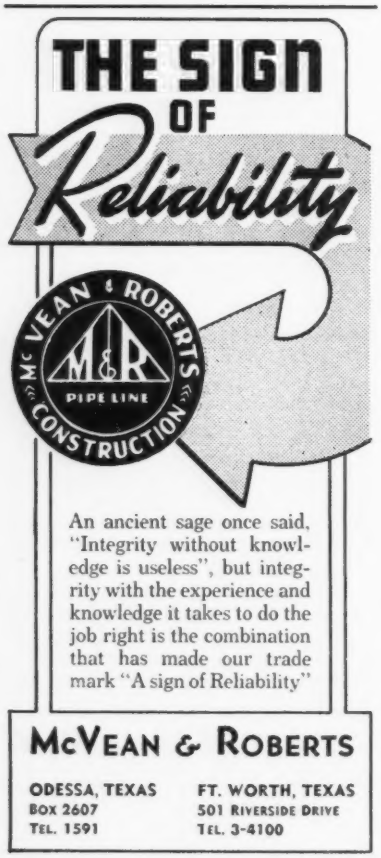
Milam County: Wilson Harding, Tr. 1 T. S. Henderson et al, in Jose Leal Sur., 3 mi. SE of Minerva, top Georgetown 3,680 ft., top Edwards 3,895 ft., dry, TD 3,908 ft., no shows.

San Patricio County: Republic Nat. Gas Co. 4 John Hancock Mutual Life Ins. Co., in Theo. Carroll Sur., 4 mi. N NW of Taft and 2¼ mi. W of Taft field, dry, TD 8,837 ft.

Starr County: Texon Royalty Co. 1 Annie M. Kelsey Bass, Eliz. A. Davis Sur. 355, 4½ mi. SE of Sacatosa gas field, dry, TD 2,600 ft.

Webb County: O. W. Killam 1 Garcia-Villareal, in Sur. 1101, 2 mi. N of Mirando City, 2 mi. NW of Oilton field, dry, TD 3,530 ft.

Willacy County: Humble 2 W. S. Murphey, in Lot 10, Blk. 75, Gulf Coast Irr. Co. Subd., in San Juan de Carricitos Grant, 1 mi. N of San Perlita, dry, TD 10,380 ft.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PERMIAN BASIN

Terry County Test Looks Good in San Andres

MIDLAND.—Amerada Petroleum Corp. 1 Sam Adair in southern Terry County had nearly 100 ft. of indicated pay zone and was showing for a promising San Andres discovery. Operators were setting casing on bottom at 4,945 ft., after running electric survey. Top of the San Andres was 4,400 ft., with pay starting at 4,815 ft. The first drill-stem test at 4,814-75 ft. recovered 122 ft. of oil and gas-cut mud, and 557 ft. of very heavily oil and gas-cut mud. A 3-hour test at 4,872-90 ft. recovered 300 ft. of oil-cut mud and 304 ft. of 33°-gravity oil. At 4,885-4,910 ft., open 4 hours, gas came to the surface in 1 hour and 45 minutes and the recovery was 62 ft. of oil and gas-cut mud, 1,128 ft. of 33.5°-gravity oil, and 113 ft. of mud. A 4-hour test at 4,908-30 ft. brought gas to the surface in 50 minutes, with a recovery of 125 ft. of oil and gas-cut mud, 1,586 ft. of oil and 140 ft. of mud. The last-reported test at 4,925-44 ft., open 4 hours, recovered 670 ft. of oil-cut mud and 158 ft. of drilling fluid. Location of the discovery is ½ mile north of the Gaines County line and 8¼ miles north of San Andres production in the Cedar Lake field.

Shell Oil Co., Inc., 1-A M. E. Cochran was showing for a new Devonian pool, 1 mile west of Ellenburger production in the TXL field of northwestern Ector County, the two areas being separated by Sinclair Prairie Oil Co. 1 Williamson, which was dry at 9,923 ft. in the Ellenburger. This test was said to have found only slight shows in the Devonian. The 1-A Cochran recovered 630 ft. of oil and 450 ft. of heavily oil and gas-cut drilling mud in a 3-hour drill-stem test at 7,975-8,052 ft. Gas came to the surface in 14 minutes. Operators were preparing to deepen.

A ¾-mile southeast extension to Ellenburger production in the Penwell field of southern Ector County was indicated at Gulf Oil Corp. 1-A Kewanee-University. A 1-hour drill-stem test at 4,977-5,027 ft. recovered 132 ft. of gas-cut mud, having a showing of oil. There was no water. Operators were drilling ahead.

In north central Crane County, Gulf's 1-HH University had indications of 315 ft. of pay. At total depth of 10,950 ft. it was 362 ft. in the Ellenburger. Operators installed blowout preventer and were to set casing on bottom, after which they would deepen about 5 ft. Latest drill-stem test, at 10,850-900 ft., produced a flow of 93 bbl. of 42.8°-gravity oil in 30 minutes and 167 bbl. at the end of 1 hour.

In northwestern Ector County, Humble Oil & Refining Co. 2-G R. B. Cowden became the eighth completed producer in the Andector field. The well, an east offset to Humble's south extension to the field, rated a flowing potential of 1,472.6 bbl. a day, with gas-oil ratio of 460 ft. Gravity was 42.7°. The flow was through a 27/64-in. tubing choke from perforations at 8,561-8,609 ft., in the Ellenburger.

Humble was reported to have acquired

a 10-year oil and gas lease on the 26,948-acre Ralph H. Harris estate ranch in south-central Coke County last week. The price was said to be a bonus of $1.75 per acre, plus 50 cents an acre annual rental, with no drilling obligations. Union Oil Co. of California's scheduled 7,000-ft. test, 3 miles east of Robert Lee, and approximately 1 mile from the southwest border of the Harris ranch, was said to be drilling below 3,000 ft., and running high, but reports were unconfirmed and no tops were released.

WEST TEXAS SUCCESSFUL WILDCATS

Andrews County: Fred Turner, Jr. 1 M. M. Fisher, Sec. 16, Blk. A-36, PSL Sur., Shafter Lake area, pumped 135 bbl. oil a day, 35° gravity, San Andres 4,330 ft., TD 4,505 ft., PB 4,456 ft., top pay 4,340 ft., elev. 3,111 ft.

Crockett County: Gulf Oil Corp. 1-R University, Sec. 14, Blk. 29, University Lands, 5½ mi. SE Clara Couch field, pumped 108 bbl. 33.3°-gravity oil a day, Grayburg pay 1,677 ft., TD 1,685 ft., elev. 2,671 ft.

WEST TEXAS WILDCAT FAILURE

El Paso County: J. S. Merriweather et al 1 Brown Realty Co., Sec. 35, Maria Rodriquez Sur., 18 mi. NW El Paso, dry at 408 ft. in limestone.

SOUTHEASTERN NEW MEXICO

HOBBS.—In Chaves County, 6 miles northeast of production in the High Lonesome field, Honolulu Oil Co. 1-21 B. W. Mullis, SE SW 21-15s-29e, an old test first drilled by Continental Oil Co., is now reported as being in line for further drilling by Richfield Oil Corp. At total depth of 10,091 ft. on last report, operators were said to be considering a much deeper test if the Basal Pennsylvanian is reached in the next 500 ft.

Richfield's 1 J. P. White, SE SW 6-12s-29e, 17 miles northwest of production in the Caprock field, was drilling below 4,510 ft. in limestone and anhydrite. Top of the San Andres was logged at 1,825 ft., on an elevation of 3,710 ft. It is to be a 10,000-ft. test. Southeast of the town of Elkins, and within the townsite, Atha Exploration Co. 1 Lightcap, 24-7s-28e, was fishing for drill pipe at 1,843 ft. It was reported to have found shows of gas at 1,204-10 ft., and a show of oil at 1,430-50 ft. in sand.

In Lea County, 6 miles north of Knowles, The Texas Co. 1-A-K State, SE SE 16-16s-38e, was drilling below 5,388 ft. in limestone, after recovering fish. This was a scheduled 5,300-ft. San Andres test but operators were considering deepening to 8,500 ft. Six miles southwest of the San Simon field J. W. Sorrels 1 Sorrels, SW SE 27-22s-34e, had a hole full of sulfur water at total depth of 4,202 ft. It topped the Yates at 3,837 ft. Eight miles south of San Simon, Allen Hargraves 1 State, SE SW 1-23s-34e, was reported drilling below 3,055 ft. in salt.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCAT

Lea County: The Texas Co. 1 W. C. Garrett, NE SE 22-16s-38e, pumped 15 bbl. oil and 15 bbl. salt water, San Andres 5,300-5,400 ft., TD 5,760 ft., PB 5,690 ft., elev. 3,716 ft.

APPALACHIAN FIELD

Chestnut Ridge Offset Runs 10 Ft. Low

PITTSBURGH.—On the Chestnut Ridge in Georges Township, Fayette County, Manufacturers Light and Heat Co. topped the Onondaga chert in the Jesse S. Eutsey, their offset to the large gas well on the J. R. Smith farm, and at 12 ft., in no gas had been struck. The chert is —4,572 ft. compared with —4,562 ft. in the Smith well where the large gas was struck 1 ft. in that formation. Here, Peoples Natural Gas Co. shut down at 7,390 ft. in the offset No. 1 W. M. Hartman or 206 ft. in the Onondaga chert and will shoot to correct a bad hole. In same company's No. 2 George Walters, the chert was topped at —5,025 ft. and at —5,085 ft. there was a small gas showing. It is now 98 ft. in that member.

In Wayne Township, Erie County, Pennsylvania Gas Co. topped the White Medina at 4,543 ft. in the test on C. J. Follette farm with 500,000 cu. ft. gas showing 1 ft. in the sand where it was shut down for test. In Green Township, Erie County, Appalachian Development Corp. has made a wildcat location on the E. M. Downing farm, elevation 1,406 ft.

New locations in southwest Pennsylvania totaled 3, one each in Patton Township, Allegheny County; Limestone Township, Clarion County; Conemaugh Township, Indiana County.

In the Jefferson district, Nicholas County, W. Va., Hamilton Gas Co. completed 11 Lewis Land & Coal Co. good for 984,000 cu. ft. gas after acidizing with 1,500 gal. in the Big Lime, placed at 1,796-2,000 ft.

In Elk district, Kanawha County, United Carbon Co. completed 1,320 R. A. Marshall good for 1,860,000 cu. ft. gas, natural, with the Corniferous Lime topped at 5,220 ft., Oriskany 5,336 ft., rock pressure 600 psi. in 24 hours; total depth 5,365 ft.

In the Ripley district, Jackson County, United Fuel Gas Co. topped the Oriskany sand in No. 5,832 J. M. Hall with the surface elevation 748 ft., Corniferous Lime 4,742 ft., Oriskany 4,844 ft.

New locations in West Virginia totaled 19 and in Birch district, Braxton County; Barboursville district, Cabell County; Cen-

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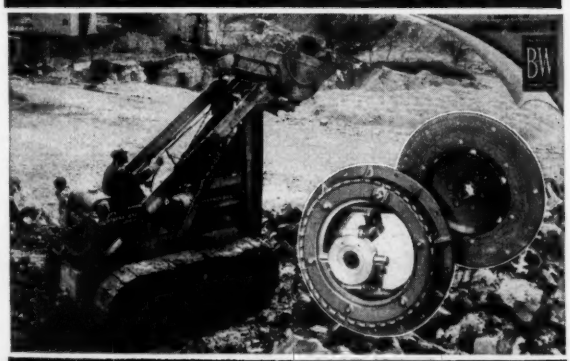

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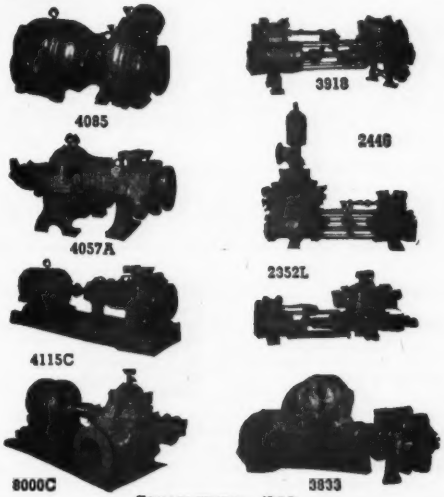

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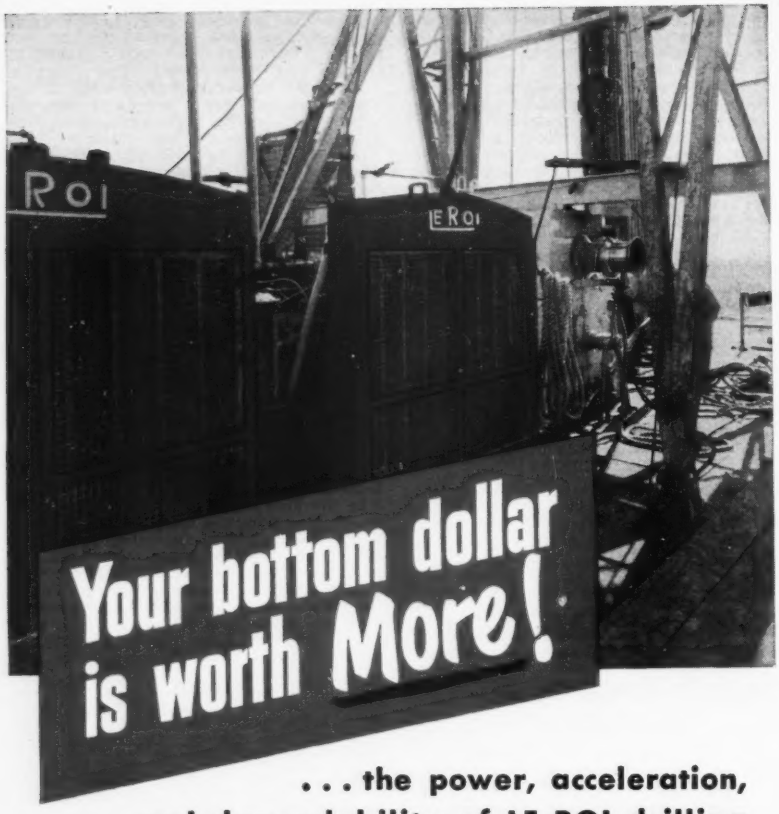

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N. CENTRAL TEXAS

New Pools in Jones And Clay Counties

WICHITA FALLS.—A new Swastika limestone field in Jones County and new Ellenburger production in Clay County, were developments the past week. In Jones County, 7½ miles north of Merkel, and 1,500 ft. northeast of Swastika sand production, Ungren & Frazier 1 M. H. Goode, W. Thurmond Survey, topped the limestone at 2,993 ft. Five feet into the formation, the hole filled 600 ft. with oil in 45 minutes, with no water. Operators were to set casing before making production tests.

In Clay County, 4 miles southeast of Buffalo Springs, Magnolia Petroleum Co. 1 Fisher, Block 114, Wood County School Land Survey, was drilling below 6 626 ft. in the Ellenburger with 1,000 ft. of fluid in the hole. There was some formation water. At 6,581 ft., approximately 67 ft. in the Ellenburger, it swabbed 23 bbl. of oil and 32 bbl. of salt water, after standing 90 hours.

A second producer for the new Bowers South field, 5 miles north of St. Jo in Montague County, was completed by Eason Oil Co. It is the 2 Temple Yarbrough, F. J. Bellow Survey A-33, which made a flowing potential of 334.32 bbl. of oil a day, based on a flow of 83.58 bbl. of 40°-gravity oil in 6 hours through ½-in. choke. Total depth is 4,043 ft., with casing set 1 ft. off bottom.

Three miles south of Montague, Continental Oil Co. 1 Paul Magee, C. A. Wright Survey A-1,052, was shot with 80 quarts at 6,470-90 ft. in the Bend conglomerate. Operators swabbed water load through tubing, after cleaning out, and will pull tubing before starting to swab on test. Six miles northeast of Throckmorton, Mayflower Properties, Inc. 1 J. J. Keeter, Section 3,033, TE&L Survey, was waiting on cement after setting casing at 4,880 ft. Total depth is 5,041 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Archer County: L. T. Burns 1 R. Campbell "B," R. R. Rainey Sur., 3½ mi. SE Anarene, pumped 10 bbl. 43°-gravity oil a day, Caddo 4,656-88 ft., TD 4,818 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: R. A. King 1-A J. J. Perkins, SPRR Sur., 2½ mi. W Holliday, dry, TD 5,065 ft., top limestone 4,098 ft., light show oil 4,098-4,125 ft.

Cooke County: John Shive et al 1 H. E. Hyman, O. R. Smith Sur., 3 mi. SW Bulcher, dry, TD 2,700 ft., sand with show oil 2,295 ft.

Wichita County: Frank Wood et al 2-B J. M. Towels, C. C. Holcomb Sur., 2 mi. E Electra, dry, TD in sand 1,655 ft.

Young County: R. V. Tidwell et al 1 J. C. Cunningham, Rebecca McGowan Sur., 2 mi. SE Murray, dry, TD 3,424 ft., Palo Pinto 1,635 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCATS

Callahan County: E. M. Fogelson et al 1 Baum-Swafford, G. M. Vigal Sur. 798, 5 mi. W Cross Plains, pumped 78 bbl. 42°-gravity oil a day, Ellenburger 3,840-60 ft., TD 3,862 ft., elev. 1,773 ft.

Stephens County: Fred M. Manning, Inc. 1 Roy Curry, Sec. 2,264, TE&L Sur., 10

mi. SW Breckenridge, flowed 112 bbl. oil in 12 hours, 3/16-in. choke, limestone pay 3,337-42 ft., TD 3,463 ft., casing pressure 1,100 lb., tubing pressure 700 lb., GOR 1,800:1.

WEST CENTRAL TEXAS WILDCAT FAILURES

Shackelford County: S. B. Roberts et al 1 G. R. Davis, Sec. 3, T&NO Sur., 15 mi. SW Albany, dry, TD 1,645 ft., slight show gas 1,341-49 ft.

Stonewall County: Tom B. Medders et al 1 C. E. Boyd, Sec. 45, Blk. D, H&TC Sur., 6 mi. SE Aspermont, dry, TD 6,232 ft., Palo Pinto 4,630 ft., Ellenburger 6,212 ft., elev. 1,576 ft.

TEXAS GULF COAST

Bee County Yoward Test Gages 165 Bbl. Potential

HOUSTON.—Gasoline Production Corp. 1 Harold E. Yoward, discovery oil well in the "Yoward" area of Bee County, about 1¼ miles west of the Mineral field, has run potential gage of 165 bbl. of 41.2°-gravity oil per day through a 9/64-in. choke through perforations at 7,483-93 ft. Gas-oil ratio 750 cu. ft. Tubing pressure was 1,050 psi, and casing 1,300 psi. The Slick sand was topped at 7,470 ft. and logged oil sand down to 7,508 ft. with water sand below to a depth of 7,520 ft. Luling sand was topped at 7,628 ft., but showed salt water. Drill-stem test in the Massive Wilcox zone at 7,955-68 ft. failed in two attempts. The 7-in. casing was set at 7,615 ft. and the hole was drilled to a depth of 8,500 ft. before plugging back for completion. This well is located in Charles B. Shain Survey, 2 miles south of Mineral. This company now is starting 1-A Yoward, in conjunction with Sunray Oil Corp., 990 ft. north-northeast of the new discovery.

Ryan Consolidated Petroleum Co. 1 Theresa H. Wagener, new oil-field discovery in Calhoun County, approximately 2 miles east-northeast of the Green Lake townsite and 2⅔ miles southwest of the Sheriff field, is retesting in new perforations at 5,926-42 ft. after swabbing at the rate of 2 bbl. of oil per hour through perforations at 5,977-92 ft. Total depth is 6,097 ft. with 5½-in. casing on bottom. On a 1¼ hour drill-stem test at 6,000-10 ft., developed 22 psi. maximum working pressure and recovered 30 ft. of 40.6°-gravity oil, and 1,320 ft. of mud cut with oil, bottom-hole pressure being 480 psi. open and 880 psi. closed. Operators squeezed these perforations and reperforated at same level and tested dry. This well is located in Tract 2, Block 1, Green Lake Farms in Manuel Lopez Grant, Abstract 25.

A new field for Newton County has been opened in South Call area by Sun Oil Co. 1 E. S. White and Sue Ella Mae Smyth West located in the Robert Goodwin League, Abstract 4. Drilled to a total depth of 11,002 ft., this well flowed a potential gage of 35.9 bbl. of fluid per day, 37 per cent of which was water and the remainder 48.7°-gravity oil. Flowing pressure on the tubing was 1,050 psi., casing sealed. Gas ratio 7,166 cu. ft. Production is through perforations in the 5½-in. casing at 10,642-656 ft.

Another new gas-producing field for Wharton County has been opened by Floyd L. Karsten 1 C. L. Tucker, an old dry hole drilled by Salt Dome Oil Corp. in 1946, which was taken over by Karsten and drilled out to a total depth of 7,178 ft. with 5½-in. casing set to the bottom. Old total depth was 7,352 ft. Operator estimates the well to be good for approximately 30,000,000 cu. ft. of gas daily on an open flow calculation. Production is through perforations at 7,081-86 ft. with 2,750 psi. pressure. This new field is 3 miles southeast of El Campo townsite and about 3½ miles west of Withers field production.

A new deep oil reservoir in the Hankamer field of Liberty County has been opened by Gulf Oil Corp. 29 E. W. Boyt in the northeasterly part of the field, in Amos Allen Survey. On potential flowed 164 bbl. of 35.3°-gravity oil daily through a ⅛-in. choke with 1,000 psi. flowing pressure on the tubing. Total depth is 7,347 ft., with 5½-in. casing at 7,331 ft. Production is through 72 perforations at 7,110-22 ft.

Houston Oil Co. of Texas 1 Eugene L. Bender Estate, wildcat approximately 3 miles off the east flank of the Humble dome in Harris County, in J. W. Singleton Survey, flowed gas and condensate on a drill-stem test at 7,786-96 ft. When tool was pulled, a considerable amount of condensate was recovered. Operators are drilling ahead. Projected depth is 8,750 ft.

W. L. Goldston 1 Jennie Ray Kauffman, Wilcox test in the Hord's Creek area of Goliad County, approximately 5½ miles southwest of Charco, is completing for a gas-condensate well through perforations at 7,900-20 ft. after drill-stem test at that level had flowed gas and condensate. No gage was made of the flow. Total depth is 8,600 ft., with 7-in. casing at 8,246 ft. This well is in P. Trevino Survey.

Tide Water Associated Oil Co. and Stanolind Oil & Gas Co. 3 M. M. Harding, 2,200-ft. extension on the southwest side of Old Ocean field, Brazoria County, flowed a potential gage of 305 bbl. daily through a 3/16-in. choke. Flowing pressure on the tubing 1,150 psi., and gravity 37.4° corrected. Production is through perforations at 10,124-132 ft. in sands showing oil from 10,100-160 ft. Total depth 11,100 ft.

There were 29 new locations reported this week with 7 being wildcats, 2 each in Chambers and Fort Bend counties and 1 each in Live Oak, Orange and Wharton counties. Two new oil pools were opened this week, one each in Bee and Newton

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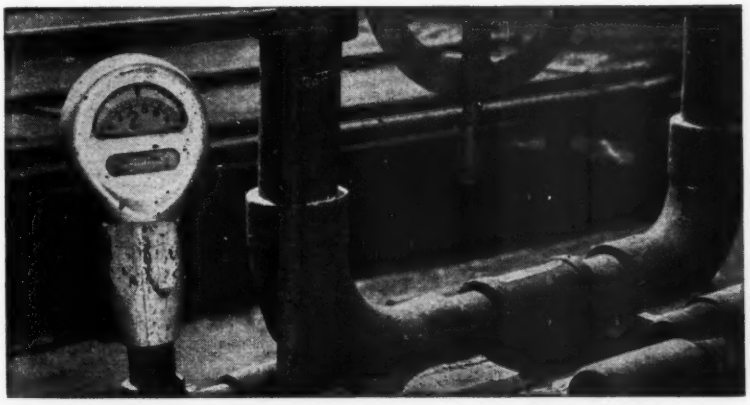

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counties, while one new pay was opened in the Hankamer field of Liberty County. Seven wildcats were dry, two each in Goliad and Karnes, and one each in Brazoria, Montgomery and Wharton counties. Total completions were 19 oil, 1 gas, and 13 dry.

TEXAS GULF COAST SUCCESSFUL WILDCATS

Bee County: New oil pool, Yoward field—Gasoline Production Corp. 1 Harold E. Yoward, in Charles B. Shain Sur., 1¼ mi. W of Mineral field and 2 mi. S of Mineral, top pay 7,470 ft. (Slick sand), TD 8,500 ft., perf. 7,483-93 ft., IP: 165 bbl. oil per day through a 9/64-in. choke, gas-oil ratio 750 cu. ft., TP 1,050 psi., CP 1,300 psi., gravity 41.2°, no water.

Liberty County: New oil pay Hankamer field—Gulf Oil Corp. 29 E. W. Boyt, Amos Allen Sur., Abstract 562, top sand 7,110 ft., TD 7,347 ft., perf. 7,110-22 ft., IP: 164 bbl. per day through ⅛-in. choke, gas-oil ratio 200 cu. ft., TP 1,000 psi., gravity 35.3°, 0.2 per cent cent water.

Newton County: New oil discovery, South Call—Sun Oil Co. 1 E. S. White and Sue Ella Mae Smyth West, in Robert Goodwin League, 14,450 ft. NW of Humble's 1 Hankamer et al, Sabine Tram field discovery, TD 11,002 ft., top sand 10,642 ft., perf. 10,642-656 ft., IP: 36 bbl. fluid per day through 8/64-in. choke, gas-fluid ratio 10,000 cu. ft., gas-oil ratio 7,166 cu. ft., TP 1,050 psi., 48.7° gravity, 37 per cent water.

TEXAS GULF COAST WILDCAT FAILURES

Brazoria County: Lee Bros. & Shuart et al 1 David C. Wilke et al, HT&B Sur., Blk. 5, Lot 4, 1¾ mi. NW of Pearland townsite, dry, TD 5,520 ft.

Goliad County: Dan Auld et al 1 Mary Kolodzey, Henry Pease Sur., 4 mi. NW of Weesatche, and ⅛ mi. SE of DeWitt County line, dry, TD 7,759 ft.

Magnolia Pet. Co. 2 Wilkinson estate, Wm. P. Miller Sur., 1 mi. NE of Berclair, dry, TD 11,494 ft.

Karnes County: J. H. Dunn et al 1 Otto Radke, in Louis Manchaca Grant, 2,500 ft. E of production at Falls City field, 3 mi. E of Falls City, dry, TD 6,110 ft.

Geo. Parker 1 Otto Platte, in David W. Isbell Sur. 47,, 2½ mi. S of Gillette, dry, TD 6,323 ft.

Montgomery County: J. D. Kinsala and W. F. Newton 1 J. B. Spiller, in Wm. H. Hulon Sur., 2½ mi. E of Moran Gas Co. 1 McIntyre Est., gas-condensate wells at Willis, dry, TD 4,512 ft., top Hockley 3,186 ft., top Cockfield 4,019 ft.

Wharton County: Jos. Hornberger and John Fergus 1 J. F. Kubela, ETRR Sur., 4 mi. SW of Pierce townsite, 2 mi. W of Withers field, dry, TD 7,156 ft.

ROCKY MOUNTAIN

Cut Bank Lime Area Gets Third Pool

DENVER.—The largest producer in the Madison lime area of Cut Bank field in Montana was completed in Union Oil Co. 9 McGuiness Unit, SE NW 6-35n-5w, opening a third pool in that formation. It topped the Madison at 3,030 ft., and was drilled to 3,080 ft. The fluid level was 1,000 ft. The 7-in. was set at 3,020 ft., and when plug was drilled it flowed at the rate of 365 bbl. per day until it was pinched down to 100 bbl.

It is located 5½ miles south of Carter Oil Co. 1 Brindley, the Madison lime discovery, completed in 1945 for 86 bbl. per day pumping and flowing at a total depth of 3,087 ft. Ten lime wells have been completed in Section 12 and the adjoining section on the east. These constitute what is known as the northern group. Dry holes on the east and west narrowed this pool down to about 1½ miles in width.

Approximately 2 miles to the south Union Oil Co. discovered the second pool in which seven oil wells, two gas wells, and one dry hole have been completed. The limits have not been determined except for one dry hole in SE SW 18-36-5w. The McGuiness Unit well is 2½ miles south of the nearest producer in the middle pool. Union drilled 7 McGuiness and 8 McGuiness to which 9 McGuiness is an offset. No. 7 was plugged back and completed as a gas well, but subsequently was recompleted in the Madison, averaging 42 bbl. of oil and 70 bbl. of water per day on a 10-day test. No. 8 McGuiness was completed as a gas well without going into the Madison. A dry hole 2½ miles south of 9 McGuiness may mark the southern limits of the third pool.

A near completion 3½ miles east and ½ mile north of 9 McGuiness, in the center of the gas area producing from the Cut Bank sand, may open another lime pool. This is Union Oil Co. 2 Teterud, SE NE 34-36-5w, which topped the Madison at 2,847 ft., and showed for 10,000,000 cu. ft. of gas per day at 2,884 ft. with sprays of oil. The gas was cased off with the 7-in. at 2,885 ft., after which it swabbed 20 bbl. from the lime in 24 hours before acidizing, and is now testing.

Barker Creek extension.—Southern Union Production Co. 18 Barker Creek, SW SW SW 11-32n-14w, Barker Creek gas field, San Juan County, northwestern New Mexico, was completed in the lower Pennsylvanian at a total depth of 9,265 ft., for 72,800,000 cu. ft. of gas per day, extending the deep sand proven area 2½ miles to the northeast of the discovery well and 2 miles from the nearest producer. It came in for 15,000,000 cu. ft., jumped to 22,000,000 cu. ft. after acidizing with 2,000 gal., and to the completion total after reacidizing with 3,000 gal.

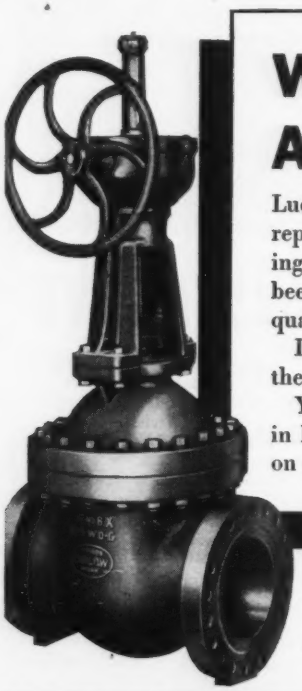
This is the largest of five deep sand wells, the others ranging from 30,000,000 to 60,000,000 cu. ft. per day. The field also produces gas from the Dakota at around 3,000 ft. The company recently placed in operation a natural-gas purification plant for the removal of the carbon dioxide and hydrogen sulfide in the deep sand gas, and has converted the discovery into a profitable enterprise. Part of the gas is used for repressuring the Dakota sand.

Rangely unit plan.—A meeting of the Rangely Operators Committee was held in Denver April 21 to consider the proposed unitization of the field. A formula for prorating production based on the results of field engineering was submitted by one of the major operators which will be discussed at future meetings. Some progress was made although no agreements were reached, and it probably will be a year or more before any contracts will be ready for signing.

Hidden Dome discovery.—Ohio Oil Co. 2 OPC-2, NW SE SE 31-48n-90w, Hidden Dome, Washakie County, Wyoming, a discovery in the Tensleep, a deeper pay, last January, has been completed at a total depth of 4,726 ft. for initial production on the pump of 240 bbl. per day. It has been shut in on account of storage being full, but will resume testing.

South Elk Basin.—Continental Oil Co. 7 Ida Goodstein, NE SE NW 20-57n-99w, South Elk Basin, Park County, Wyoming, an outpost on the north and only 2½ miles south of the nearest Tensleep producer in Elk Basin, was completed for 192 bbl. of fluid per day, 25 per cent water, on a swabbing test. It will be put on the pump. The Tensleep was found more than 100 ft. higher than in the highest well to the south, and was expected to be a much better well, but source of water intrusion has not yet been ascertained, apparently is not from the sand.

New operations.—Twenty new operations were reported, of which three were in Colorado, nine in Wyoming, four in Mon-



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tana, and four in northern New Mexico. The Colorado locations included one each in Rangely and East Hiawatha, and one wildcat. The Wyoming locations include one each in Big Hollow, and Herrick, Albany County; Big Muddy; East Lance Creek; Frannie; Mush Creek; Little Buffalo Basin; and Gebo. The Montana locations were one each in Bowdoin and Kevin-Sunburst field, and 2 in Cat Creek. The New Mexico locations include two in Fulcher Basin, one in Kutz Canyon, and one in the Black Mesa District, Union County.

WYOMING SUCCESSFUL WILDCATS

Hidden Dome, Washakie County: Ohio Oil Co. 2 Tensleep OPC-2, NW SE SE 31-48n-90w, TD 4,726 ft., top Tensleep 4,549 ft., elev. 3,844 ft., ground, pumped rate 240 bbl. per day initial test, still testing.

Steamboat Butte, Fremont County: Brinkerhoff Drilling Co., Sohio Oil Co. 1 Tribal, NW NW NW 9-3n-1w, TD 6,923 ft., top Tensleep 6,828 ft., pumped 847 bbl. in 22 hours. Extension 1 mile to southeast.

OHIO, KENTUCKY

Another North Extension For Pittsfield Pool

COLUMBUS.—The Pittsfield pool in Lorain County was again extended to the north. Ohio Fuel 1 Earl Heiden, Lot 104, drilled the Clinton at 2,165-73 ft. with a gage of 1,950,000 cu. ft. natural. The company plans to drill both east and north offsets to this well.

The Industrial Gas-Foraker 2 Rambo, Section 33, York Township, Morgan County, which had an excellent showing of oil was shot with 60 qt., but failed to clean itself and was nearly plugged off. Tools are now stuck in the hole, but the operators expect no trouble in bringing them up and cleaning out will be continued.

Ashland County continues as a good gas producer with two completions last week. F. E. Barnhart 1 Emma Bowman, Section 10, Hanover Township, found the Clinton at 2,882-94 ft. with a gage of 330,000 cu. ft. natural and 900,000 cu. ft. when shut in after shot. Ohio Fuel 2 Musk. Con. District, Section 23, Mifflin Township, extended the Mifflin pool a location to the south. The Clinton sand at 2,405-16 ft. made 1,430,000 cu. ft. natural.

The Ohio Oil Co. will drill a 5,000 ft. rotary test to the granite in Logan County unless oil or gas is found in an upper horizon. The test well is located on the J. C. Harrod tract, Lot 9965, McArthur Township.

New locations increased this week to 28. Stark County reported six, Wayne 4, Tuscarawas, Muskingum, and Monroe three, Lorain and Guernsey two, and the balance scattered. Completions totaled 22.

OHIO WILDCAT FAILURE

Ashland County, Orange Township: Ohio Fuel Gas 1 Brady Stave Co., Sec. 23, dry, Clinton 2,761-69 ft., TD 2,800 ft.

EASTERN KENTUCKY ACTIVITIES

ASHLAND.—Two completions and two deepenings were noted in the eastern Kentucky field operations during the week. Kentucky-West Virginia Gas Co. completed No. 840, John M. Yost property, Pike County, at 3,369 ft. for 215,000 cu. ft. in shale after shot. Some company completed No. 5, 708, J. S. Cline property, Pike County, at 3,540 ft. for 582,000 cu. ft. from the Weir, Berea, and shale pays

No. 760, Dan J. Syck, 2,715 ft. in coffee shale, and No. 812, E. L. Pinson, both in Pike County, 1,567 ft. in red rock, were being deepened.

WESTERN KENTUCKY

OWENSBORO.—Western Kentucky reported 15 completions during the past week, including 3 wildcat failures and 10 producing oil wells, 4 of which were in Butler County. There were 10 first reports, including 3 wildcat tests, 1 each in Henderson, Webster and Todd counties.

WESTERN KENTUCKY WILDCAT FAILURES

Butler County: Cook Brothers 1 C. C. Anderson, 21-H-32, dry at 489 ft., Viola 100 ft., Upper Glen Dean 201 ft., Golconda 316 ft., Jackson 374 ft.

Henderson County: Carter Oil Co. 1 Delmer Brantley, 6-O-22, dry at 2,767 ft., Viola 1,821 ft., Glen Dean 1,971 ft., Ste. Genevieve 2,552 ft., McClosky 2,617 ft.

Ashland Oil & Refining Co. Basin 1 Latta-Duncan, 14-P-21, dry at 2,793 ft., elev. 419 ft., Viola 1,828 ft., Glen Dean 2,037 ft., Golconda 2,193 ft., Cypress 2,553 ft., Ste. Genevieve 2,608 ft., McClosky 2,673 ft.

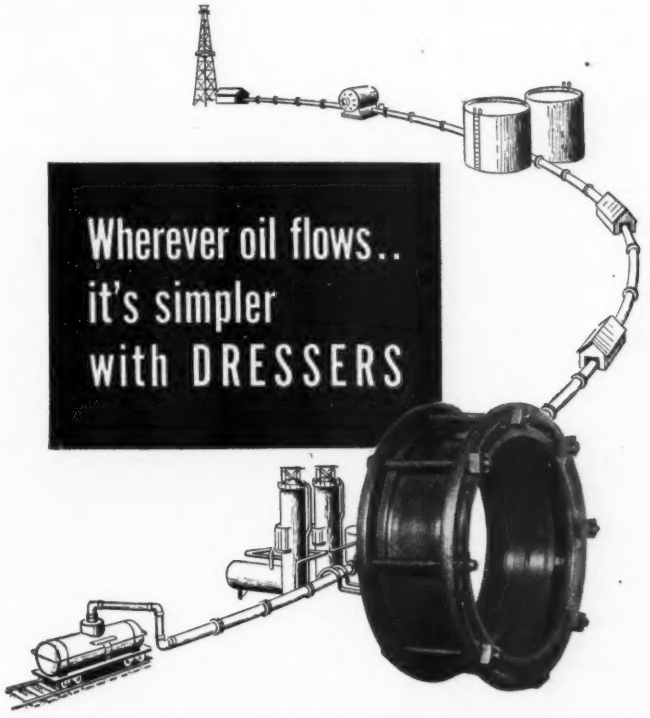
INDIANA

EVANSVILLE.—O. L. Strubois 1 Wright, SE NW NW 29-6s-7w, Spencer County, has been completed as a 12-bbl. pumper in the Palestine at 915-26 ft. Total depth is 1,614 ft. This test is about 2 miles northeast of the Hatfield pool, which produces from the Waltersburg at about 1,014 ft.

Wildcat tests in more or less advanced stages of completion are: S. D. Jarvis 1 Hart-Wright, NW 31-1s-10w, Gibson County, drilling below 1,710 ft. C. E. Skiles 1 Turner, NE NE SW 3-2s-12w, Gibson County, drilling below 2,073 ft. J. L. Black 1 Kennett, NW NE SW 20-8n-10w, Sullivan County, drilling below 2,418 ft. Roy Myers 1 Thomas SE 19-9n-10w, Sullivan County, drilling below 3,317 ft. Isaacson Oil Co. 1 Hillman, 14-10n-11w, drilling about 2,400 ft.

INDIANA SUCCESSFUL WILDCAT

Spencer County: O. L. Sturbois 1 Wright,



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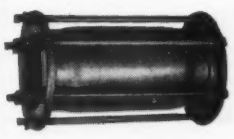

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CALIFORNIA

Oceanic Sand Discovery Back on Production

LOS ANGELES.—Seaboard Oil Co.'s Oceanic oil sand discovery in the Bacon Hills area of Kern County, the 3-21 Seaboard-Bandini, 21-28s-20e, has been restored to production and at latest reports was swabbing and flowing by heads at the rate of 52 bbl. every 10 hours. The oil is clean and tested 37.5° gravity. Flow is through a 48/64-in. choke.

Originally completed 3 weeks ago for an estimated flow of 500 bbl. daily from a depth of 7,846-76 ft., the well subsequently starting making all water and was killed for water shut-off. Following water shut-off at 7,775 ft., casing was reperforated at 7,846-76 ft. and tubing run to 7,847 ft. The well was then swabbed in to flow at the rate of 150 bbl. daily. It started heading shortly afterwards, however, and died about 30 hours later.

Operators are of the opinion that the perforations may be plugged and in need of washing. If this operation fails to restore the flow and increase production, the well may be placed on the pump. These latest production tests of the 3-21 Seaboard-Bandini, are considered sufficiently good to justify a follow-up well, and location is now being graded for the 24-21 Seaboard-Bandini in Section 21-28s-20e.

Sharples Oil Corp.'s first drilling venture in California, the 1 Hyde, 6-19s-16e, was successfully completed during the past week flowing at an estimated rate of 200 to 400 bbl. of 26° gravity oil and 200,000 cu. ft. of gas daily through a 20/64-in. choke. Production is coming from the Gatchell sand at a plugged-back depth of 8,380 ft. Shortly after completion, the flow died, but the well was restored to production and is now swabbing and flowing by heads. Gas pressure is believed insufficient for steady flow.

The 1 Hyde is an outpost well of the northeastern extension area of the Coalinga field and extends production approximately 1 mile to the northeast. Indications are that additional drilling may widen the area several miles further, and a second well is being started in Section 6-19s-16e.

Richfield Oil Corp. is grading location for the 45 Ojai in 13-4n-22w, along the edge of the old Ojai field in Ventura County. This will be the third test in a series of ventures projected by Richfield several years ago. Original plans called for drilling three wildcats in a triangular pattern in an effort to locate deeper producing zones in the field. Two former tests were drilled to depths around 4,000 ft. without finding any evidence of commercial accumulations, and the 45 Ojai is expected to tell the story. Richfield now maintains about 25 pumping wells in the field which are producing from a sand at a depth of approximately 1,000 ft.

Pacific Western Oil Corp. 1 National Royalties, 5-26s-22e, wildcat in the Miramonte area of Kern County, showed a light, steady blow for 5 minutes and a heading blow for 12 minutes during a 17-minute formation test at 11,940-12,090 ft. during the past week. Recovery was 2,300 ft. of heavily gas-cut mud. The test was made using a 2,970-ft. water cushion with packer set at 11,815 ft. Operators are now cleaning out to retest.

The 1 National Royalties was originally drilled to a total depth of 16,668 ft., but was plugged back to 12,100 ft. for testing when efforts to recover stuck drill pipe at the lower depth were unsuccessful. This well held the distinction of being the world's deepest well for a short period.

New locations dropped to 42 during the week, a decrease of 8 from the previous week. Cymric and Wilmington each received six of the projected ventures, while the remainder were scattered throughout various fields.

CALIFORNIA SUCCESSFUL WILDCATS

Kern County, Midway-Sunset area: General Petroleum Corp. 14 Pacific, 32-12n-23w, flowed 121 bbl. day through 32/64-in. choke, 15 per cent cut, elev. 594 ft., TD 3,775 ft.

Mount Poso area: M. R. M. Syndicate 4 Claire, 22-28s-28e, placed on pump April 22, no gage, elev. 840 ft., TD 2,945 ft.

CALIFORNIA WILDCAT FAILURES

Humboldt County, Hydesville area: The Texas Co. 1 Anderson, 8-2n-1e, dry, elev. 446 ft., TD 9,082 ft.

Kern County, Arvin area: Hancock Oil Co. 1 Di Giorgio, 4-31s-29e, dry, elev. 476 ft., Edison shale 5,917 ft., Santa Margarita 6,483 ft., schist 6,192 ft., TD 6,475 ft.

Honolulu Oil Corp. 1 Honolulu et al, 15-31s-29e, dry, elev. 450 ft., schist 7,807 ft., TD 7,810 ft.

Jasmine area: Superior Oil Co. 51 Quinn, 20-25s-27e, dry, elev. 575 ft., TD 3,926 ft.

Santa Barbara County, Capitan area: Rothschild Oil Co. 2 Orella, 31-5n-30w, dry, elev. 75 ft., TD 3,882 ft.

CANADIAN FIELDS

Good Well in Deeper Zone At Turner Valley North

CHATHAM.—In the Turner Valley north extension, Foothills Oil & Gas 11, LSD 11, 4-21-3w5, completed in 1942 and recently deepened in the Madison limestone from 7,422 to 8,546 ft. developed initial production of 782 bbl.

Leduc.—In the Leduc area, southwest of Edmonton, Imperial-Leduc 1 discovery well delivered 4,187 bbl. of light crude in February, representing production for part of the month. Imperial-Leduc 2, LSD 1, 16-50-26w4, south and west of the discovery, is close to the producing depth of the latter, 5,066 ft. Two other tests are rapidly nearing completion.

Edson.—In Northern Alberta, 50 miles northwest of Edson, Northern Foothills Agreement Muskeg 1, SE 24-57-6w6, has started drilling. The test is jointly sponsored by Imperial Oil, McColl-Frontenac Oil Co., Shell Oil, Gulf Oil and Socony-Vacuum, and is being drilled in previously untested territory.

Blackfoot Reserve.—An important new test has been spotted for a group of Alberta companies on the Blackfoot Indian Reserve in the plains area of southern Alberta. The test is Crowfoot 1, in LSD 14,

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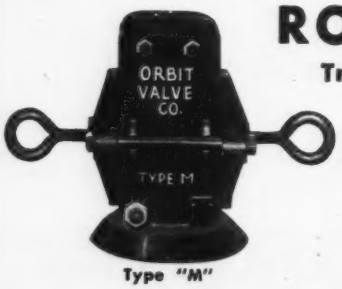

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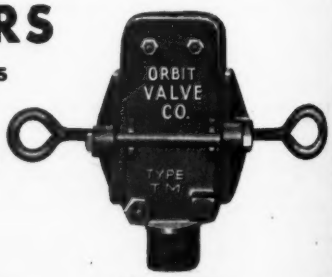

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33-20-19w4, about 8 miles southwest of Bassano and about 5 miles west of one of the first wells drilled in Alberta, Bassano 1, LSD 12, 8-21-18w4, which got a small gas production but was not carried to conclusive depth.

De Winton.—Royalite Oil Co. of Calgary has located Royalite-De Winton 2 in LSD 13, 24-21-1w5, being its second venture in the De Winton area about 15 miles south of Calgary. Location is east of the Turner Valley north extension.

Del Bonita.—Resuming after the winter shut down, McLeod 1, LSD 13, 14-1-21w4, in the Del Bonita area of southern Alberta, is perforating and acidizing in the upper porous lime at 4,915-45 ft. The test, bottoming at 4,965 ft., last fall got the lower porous at 4,960 ft. with good gas indications and will probably deepen in that horizon after testing the upper porous.

KANSAS

Barber Co. Simpson Test Gets Saturation 7 Ft. High

SKELLY OIL CO. 1 Hamlin, SW NE NW 10-33s-12w, Barber County, located 2 miles northeast of the Boggs pool, found the top of the Simpson sand at 4,790 ft., some 7 ft. higher than in the highest well in the Boggs pool. Saturation and porosity were logged in the top 11 ft. of the Simpson and casing has been set to test further. The total depth is 4,820 ft. Top of the Lansing was logged at —1,330 ft., Mississippi at —2,897 ft., Viola at —3,200 ft., and Simpson at —3,301 ft.

In Marion County, 5 miles south of Lost Springs pool, R. E. Youker et al have set pipe at 2,384 ft. in 1 Henke, SW SE SW 33-18s-4e, to test good oil show. Kansas City was logged at 1,836 ft. and Mississippi lime at 2,378 ft.

Five miles south and slightly east of Pawnee Rock pool, J. M. Huber et al 1 Torrance, SW SW SW 19-21s-15w, Pawnee County, on drill-stem test at 3,844-54 ft., in the Arbuckle, had a gas flow estimated at 2,000,000 cu. ft. Heebner was logged at 3,363 ft., Lansing at 3,466 ft., and Arbuckle at 3,843 ft.

Western Drilling Co. 1 Freeland, NE NE SW 25-18s-37w, Wichita County, a rank wildcat 24 miles northwest of the Shallow Water pool and about 30 miles northwest of the present limits of the Hugoton gas field, has been abandoned in Arbuckle lime at 5,630 ft. Mississippi was logged at 4,998 ft., Viola at 5,468 ft., and Arbuckle at 5,555 ft. Elevation is 3,305 ft.

Twenty-five miles northeast of the Fairport pool, A. W. Ault has derrick up for 1 Hobbie, NW NW SE 27-9s-11w, Osborne County.

KANSAS WILDCAT FAILURES

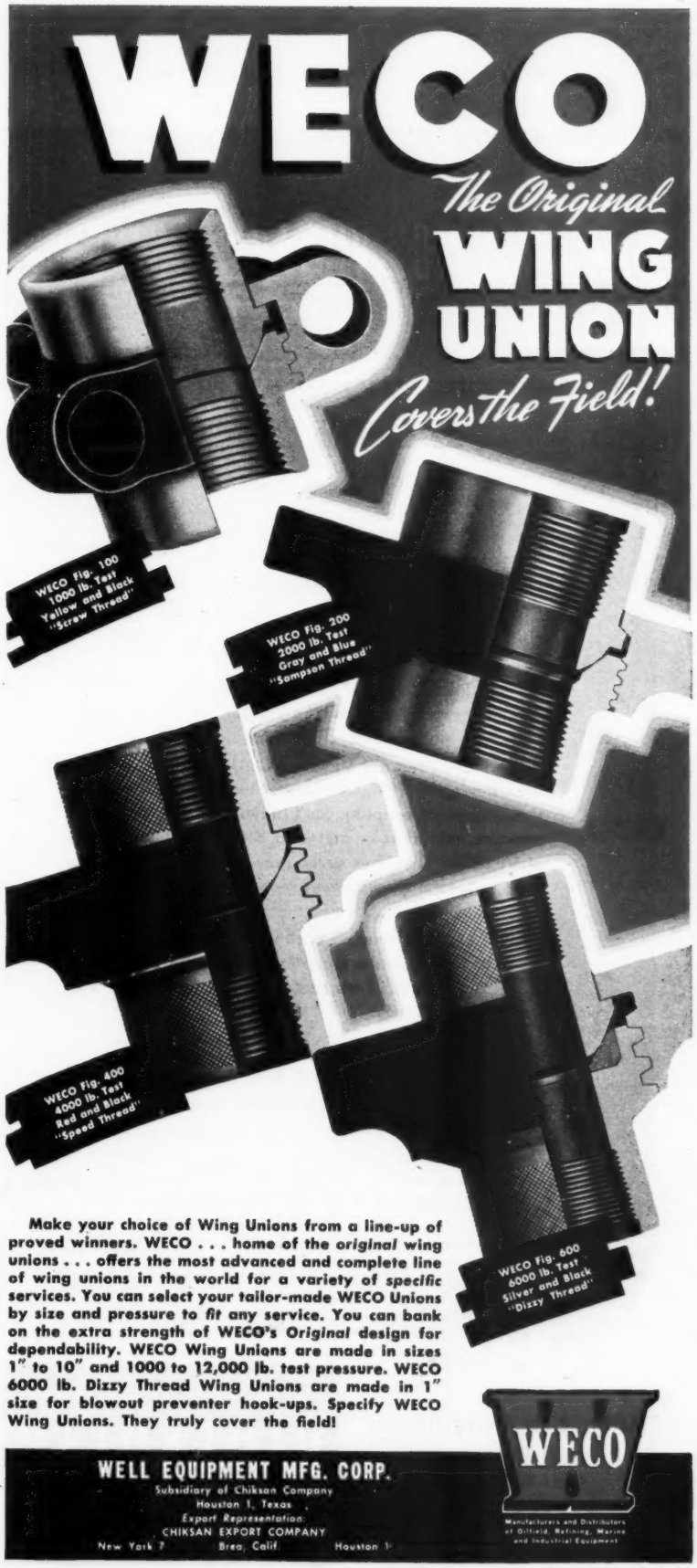
Barber County: J. M. Huber et al 1 Peckenpaugh, SW SW NE 34-32s-14w, dry TD 5,336 ft., Lansing-Kansas City 4,231 ft., Viola 5,095 ft., Mississippi lime 4,727 ft., Simpson 5,296 ft., Arbuckle 5,306 ft.

Gray County: Cities Service 1 Snyder, C NW SE 18-28s-28w, dry, TD 6,445 ft., anhydrite 1,730 ft., Herrington 2,702 ft., Upper Krider 2,730 ft., Lower Krider 2,754 ft., Winfield 2,804 ft., Ft. Riley 2,848 ft., Topeka 3,790 ft., Heebner 4,180 ft., Lansing-Kansas City 4,330 ft., Mississippian 5,119 ft., Viola 6,182 ft., Arbuckle 6,354 ft.

Greenwood County: Delbert Mossman 1 Holland, SW NE SW 24-23s-11e, dry, TD 2,665 ft., Mississippian 1,893 ft., Arbuckle 2,610 ft.

Kingman County: Phil-Han & Gulf Oil 1 Albritten, SW SW SW 6-29s-10w, dry, TD 4,712 ft., Lansing-Kansas City 3,749 ft., Mississippian 4,292 ft., Viola 4,535 ft., Simpson 4,612 ft., Arbuckle 4,693 ft.

Marion County: Darrah & Aurell & Davis 1 Olson, NE NE NW 8-20s-3e, dry, TD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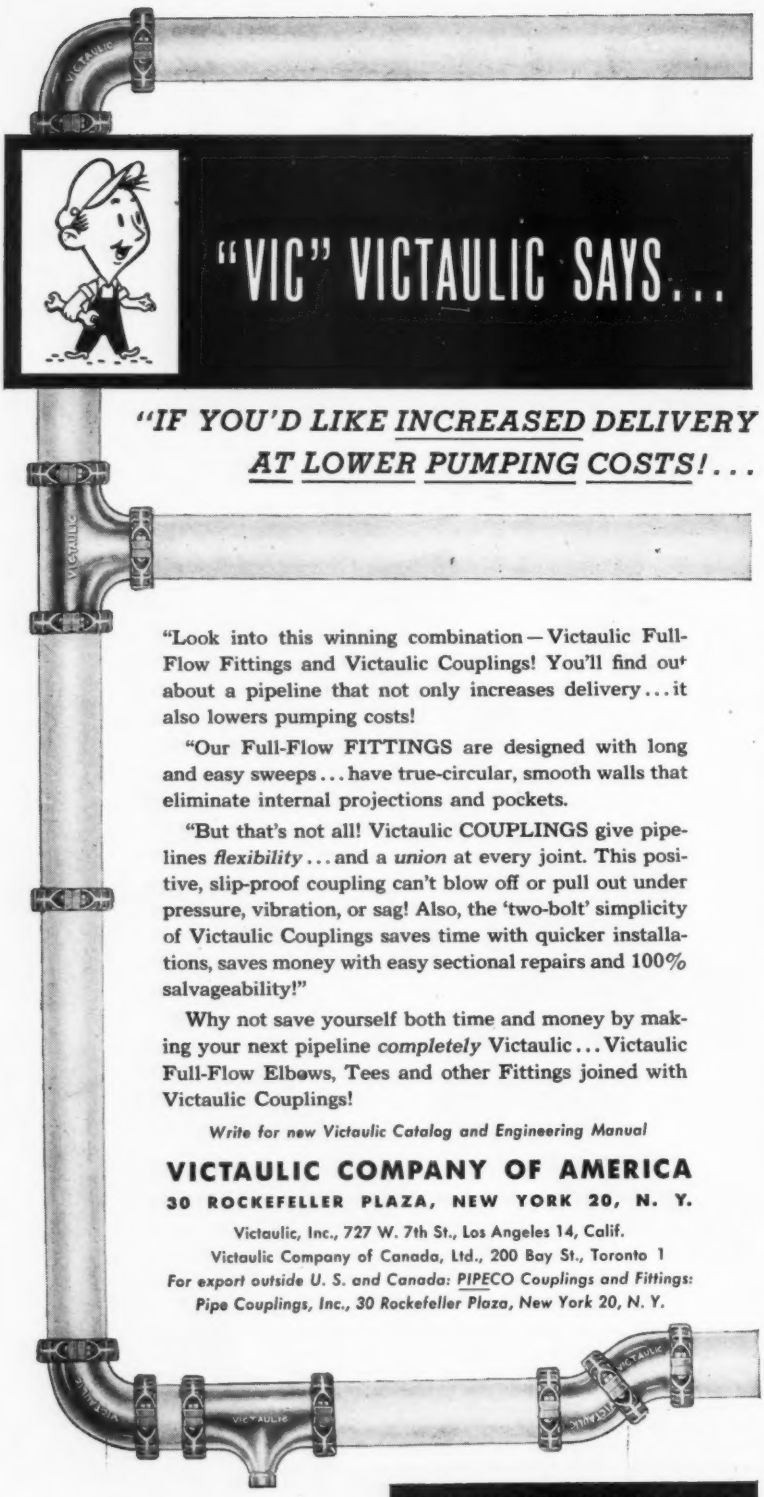
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2,950 ft., Kansas City 1,870 ft., Basal Kansas City 2,275 ft., Mississippi lime 2,560 ft., Viola 2,857 ft., Simpson 2,865 ft, Wilcox 2,868 ft., Granite Wash 2,918 ft.

Rush County: Huber & Wakefield 1 Ficken, NW NW NE 32-19s-18w, dry TD 4,095 ft., anhydrite 1,310 ft., Heebner 3,594 ft., Dodge 3,612 ft., Lansing-Kansas City 3,640 ft., Arbuckle 4,055 ft.

Russell County: C. W. Trickett et al 1 Bochman, C S/2 NW 35-14s-12w, dry, TD 3,355 ft., anhydrite 580 ft., Lansing-Kansas City 2,881 ft., Basal Kansas City 3,146 ft., conglomerate 3,164 ft., Arbuckle 3,182 ft.

OKLAHOMA

Gas Distillate Discovery In Basal Pennsylvanian

SKELLY OIL CO. 1 Adams, SW SE 20-13n-2w, Oklahoma County, 6 miles east of the Britton pool, flowed 9 bbl. distillate in 3 hours, and gas at an estimated rate of 5,000,000 cu. ft. per day through pipe perforations at 6,106-22 ft. in basal Pennsylvanian sand. Pipe was set at total depth of 6,204 ft.

The pay zone is not the same zone from which the Peppers Refining Co. 1 Martin Estate produces ½ mile north in SW NE of the same section. The Martin Estate well, which is the Wicher pool discovery well, produces gas and distillate from Bartlesville sand at 6,065-84 ft. The Skelly well logged Prue at 5,910 ft., Verdigris at 5,957 ft., base of Pennsylvanian and top of Bois d'Arc Hunton at 6,103 ft.

Two Ordovician Bromide sand wells are good prospects on the east side of the Southwest Antioch pool, which has 44 wells producing from the Gibson Pennsylvanian sand. Globe Refining et al 1 Carr, NW NE SE 29-3n-2w, Garvin County, was drilled to 8,250 ft. Pipe will be set at 8,050 ft. First Bromide was topped at 7,216 ft. A drill-stem test at 7,272-93 ft. recovered 2,100 ft. of 42°-gravity oil, and one at 7,471-7,588 ft. flowed an estimated gas volume of 1,000,000 cu. ft. and 50 bbl. 40°-gravity oil per hour. Globe Refining 1 Pyle, NW NW SE 20-3n-2w, stopped at 7,227 ft. and will run casing to test Bromide topped at 6,977 ft.

R. L. Bauman & Max Pray 1 Myers, NW NW 7-4n-3w, Garvin County, which extends the East Lindsay pool 1 mile to the southeast, is flowing 50 bbl. oil per hour through perforations in Bromide section from 9,840-10,105 ft., total depth 10,205 ft. The same operators are drilling below 9,885 ft. in 1 Frankenburg, NW NE 7-4n-3w. First Bromide was topped at 9,600 ft.

Two miles east of the Frankenburg, Carter Oil Co. 1 Bradshaw, NW SE 4-4n-3w, is drilling below 7,295 ft. A drill-stem test at 7,150-67 ft. recovered an estimated gas flow of 500,000 cu. ft. per day, 120 ft. oil and gas-cut mud and 40 ft. 37.5°-gravity oil. A second drill-stem test at 7,270-95 ft., in Deese, showed gas in 4 minutes, estimated at 1,200,000 cu. ft. per day, and recovered 30 ft. distillate and 30 ft. oil and gas-cut mud. The test is drilling below 7,298 ft.

Carter Oil Co. 1 Helvey, SE NW 25-2s-2w, Garvin County, potential connecting link between the Katie and Elmore City pools, is drilling below 6,308 ft. The Deese section was topped at 6,192 ft.

Texas Co. 1 Denny, NE NE NE 1-2s-4w, Stephens County, filled up 3,500 ft. with oil from perforations at 6,850-65 ft. This test is located midway between Sholem Alechem and Milroy pools. Pipe was set at 7,005 ft. and hole was plugged back to 7,170 ft. from total depth of 7,382 ft.

Jordan Petroleum Co. 1 Porter, NE SE SE 30-16n-1e, Logan County, is being completed as a gas well in the Bartlesville, topped at 4,879 ft. Pipe was set at 4,873 ft., total depth 4,887 ft. On short test, well was estimated at 50,000,000 cu. ft., with no oil or distillate. The well is about 2 miles west of the

Meridian pool which produces oil from the Simpson.

OKLAHOMA WILDCAT FAILURES

Caddo County: Magnolia Petroleum Co. 1 Miller, C NW NE 14-6n-9w, dry, TD 4,675 ft., no tops reported.

Coal County: Magnolia Petroleum Co. et al 1 Hockett, NE SE NE 10-2n-8e, dry, TD 7,767 ft., Gilcrease 3,891 ft., Wapanucka 5,110 ft., Union Valley 5,602 ft., Cromwell sand with stain of oil 5,619 ft., chert 5,970 ft., Mayes 6,210 ft., Woodford 6,382 ft., Hunton lime 6,520-50 ft., Sylvan 6,872 ft., Viola 7,001 ft., Bromide 7 239 ft., sandy lime 7,290-7,320 ft. and 7,490-7,502 ft.

Cotton County: E. P. Griffen 1 Russell, NE NE SW 16-2s-13w, dry TD 1,987 ft., broken sand 800-1,210 ft., limy sand 1,210-40 ft., 1,490-1,502 ft. and 1,925-70 ft., Granite Wash 1,970 ft.

Grant County: Sunray Oil Corp. 1 Kent, NE NE NE 21-26n-8w, dry, TD 6,471 ft., Tonkawa 4,095 ft., Layton 4,535-4,625 ft., Checkerboard 4,655 ft., Big lime-Oswego 4,790 ft., Mississippian 5,319 ft., Hunton 5,975 ft., Viola 6,016 ft., 2nd Wilcox 6,106 ft.

McClain County: Big Chief Drilling Co. 1 Sasser, NW SE NW 30-6n-2w, dry, TD 9,017 ft., Pawhuska 4,410 ft., Oread 5,200 ft., Hogshooter 6,360 ft., Checkerboard 6,560 ft., Deese 6,820 ft., Base Pennsylvania-Woodford 7,730 ft., Hunton 7,770 ft., Sylvan 8,127 ft., Viola 8,263 ft., 1st sand 8,762 ft., 2nd sand 8,800 ft.

Noble County: Gulf Oil & Mazda Oil Corp. 1 Hon, NE NE SW 34-24n-1e, dry, TD 4,840 ft., Layton 3,209 ft., Checkerboard 3,608 ft., Oswego 3,787 ft., Prue 4,027 ft., Mississippian 4,363 ft., Woodford 4,692 ft., Viola 4,728 ft., 2nd Wilcox 4,775 ft.

Okfuskee County: D. T. Ingling & R. MaGuire 1 Simmer, SW NW NW 26-10n-8e, dry, TD 3,625 ft., brown lime 3,010 ft., Booch 3,150-80 ft., Gilcrease 3,390-3,435 ft., Cromwell 3,599 ft.

Payne County: Deep Rock Oil Corp. 1 Manning, NW SE NW 29-18n-6e, dry, TD 3,892 ft., Big lime 2,830-60 ft., Woodford 3,692 ft., Viola 3,739 ft., dolomite 3,799-3,805 ft., Wilcox 3,805-58 ft.

Pontotoc County: Garr & Sooley 1 Stanfield, SE NW NW 28-3n-4e, dry, TD 1,236 ft., sand 951-70 ft., Viola 1,216 ft.

Pottawatomie County: Danciger Oil & Refining Co. 1 Bowlan, SE SW NE 34-10n-3e, TD 5,338 ft., Avant 2,780 ft. Belle City 2,845 ft., Hogshooter 3,240 ft., Checkerboard 3,555 ft., Wewoka 4,078 ft., Verdigris 4,320 ft., Skinner 4,340 ft., Inola 4,640 ft., Mayes 4,845 ft., Woodford 4,950 ft., Hunton 5,086 ft., Sylvan 5,119 ft., Simpson dense 5,250 ft., dolomite 5,298 ft., Wilcox 5,333 ft.

MISSISSIPPI

North Extension Likely At Brookhaven

JACKSON.—In the Brookhaven field, which reported 3 completions last week, The California Co. 1 John Smith, 29-8n-7e, was expected to make a north extension to the field. Casing was perforated at 10,520-522 ft., and squeezed. Tubing was to be run for production tests on new perforations at 10,520-541 ft., and 10,552-558 ft.

Humble Oil & Refining Co. 1 C. Tullos, 12-1n-18w, Marion County, was coring below 10,026 ft. in the Comanchean, with no shows. Sidewall cores have been taken in all sands of the upper and lower Tuscaloosa, with no shows found except in the lower Tuscaloosa stringer sands. Cores from 8,998-9,883 ft. indicated shows of oil at 9,041, 9,043, 9,050, 9,052, and 9,054 ft., with the balance having no shows. Salt water was found at 9,054 ft. The Tullos was planned to 11,000 ft., some 500 ft. deeper into the Comanchean than any other test in the Hub field area, and operators expect the gas-distillate sand around 10,090 ft.

A southeast extension was in sight for the La Grange field, Adams County, when Big Chief Drilling Co. 1 F. M. Baker, 34-6n-2w, cored oil sand at 6,180-82 ft., then recovered 1,260 ft. of 38°-gravity oil on a drill-stem test. Pipe was being set for production tests.

In Jones County, Gulf Refining Co. 1 Majors, 29-6n-11w, cored at total depth of 11,497 ft. in the Comanchean, with no recent shows reported. Electric survey was run to 11,492 ft.

MISSISSIPPI WILDCAT FAILURE

Neshoba County: Slick Oil Co. and Plains Prod. Co. 1 J. D. Breazeale, 28-12n-10e, dry, TD 6,132 ft., Selma 1,797 ft., Eutaw 2,664 ft., Tuscaloosa 3,242 ft., Massive sand 3,880 ft., Travis Peak 4,317 ft., Cotton Valley 5,387 ft., elev. 398 ft., no shows.

MICHIGAN

New Dundee Pool Apparent in Bay County

SAGINAW.—A new pool in Bay County seems assured by McClanahan Oil Co. and L. R. Reese 1 Mercer & Knoodle, SW SE SE 13-17n-3e, which has been shut down and temporarily bottomed with a 150-ft. fill-up of free oil in the Dundee at 3,016 ft. The wildcat is approximately 3 miles south of the Sohio et al 1 State, discovery well of the Mount Forest pool completed last year, also a Dundee producer. Last reports were that operators were running casing at 3,010 ft. and moving in tanks preparatory to drilling the well in.

The new Kimball Lake field in Newaygo County had its third completion in Sun Oil Co. 1 Anderson, NE NW NW 14-12n-13w, which flowed over 60 bbl. of oil per hour from perforations at 2,340-51 ft. in the Traverse lime. This southeast offset to the discovery well was scheduled to test the Reed City zone but was plugged back some 500 ft. to 2,385 ft. after a nitro shot damaged the 5-in. casing. The field is being further defined by the company's 1 Purcell, NE NE SE Section 10, the farthest north well scheduled to test the Traverse zone, which logged and cored pay at 2,340-44 ft., and flowed 10 bbl. of oil after a drill-stem test at 2,357 ft.

Eight new permits for the week included three wildcat starts, one each in Allegan, Kent, and Newaygo counties, and five field starts, one each in Kawkalin field, Bay County, Coldwater field, Isabella County, Walker field, Kent County, Greendale field, Midland County, and North Zeeland field, Ottawa County.

MICHIGAN SUCCESSFUL WILDCAT

Newaygo County: Michigan Devonian Petroleum Co. 1 Corey Estate, NE SW NE 16-16n-11w, Traverse 3,068 ft., 60 bbl. of oil, TD 3,098 ft.

LA.-ARK.

Natchitoches Test Now Drilling in Paluxy

SHREVEPORT.—Operators were drilling ahead below 3,520 ft. in Paluxy topped at 3,271 ft. at J. F. Lent et al 1 E. L. Whatley, 20-10n-10w, Natchitoches Parish. Cores at 3,340-56 ft. recovered 8½ ft. of black shale, with no shows, and at 3,356-76 ft. the recovery was 18 ft. of black and gray shale, with no shows. Last week this test was showing for a possible discovery when 60 ft. of oil-cut mud was recovered from 3,253-85 ft.

In Franklin Parish, 4 miles southwest of South Big Creek, Big Chief Drilling Co. 1 David Stack, 1-15n-7e, was drilling below 3,343 ft. in Tuscaloosa. Cores at 3,005-10 ft. recovered fine, dark gray, slightly sandy shale, with no shows. Cores at 3,027-32 ft. recovered firm, gray, porous silty sand, with no shows. Gas rock was logged at 3,001-04 ft. Lion Chemical Corp. Bienville Parish test, the 1 Ozley, was acidized again, with 4,000 gal., at 10,680-737 ft. and swabbed down to 9,000 ft. Shut in overnight, pressure built up to 2,200 psi. and it made an estimated 100,000 cu. ft. of gas a day. Plug was set at 10,158 ft. and new perforations made at 10,090-120 ft. Operators washed with fresh water but recovered no shows. On last report it was swabbing at 3,000 ft., with no shows.

In Arkansas, Placid Oil Co. 1 Farmers Bank & Trust Co., 1-17s-20w, Columbia County, was drilling below 5,995 ft. in Cotton Valley. Nine miles northwest of Prescott, Hempstead County, C. L. Wickcliffe 1 Ward was testing in the Eagle Mills after perforating liner at 1,760-70 ft. North of the McKamie field, Lafayette County, McAlester Fuel Co. 1 Texas Co.-Lee, was drilling below 6,498 ft. in Travis Peak.

NORTH LOUISIANA WILDCAT FAILURE

Madison Parish: Victor Grage 1 Madison Parish School Board, 35-18n-13e, dry, TD 4,515 ft., chalk 3,866 ft., gas rock 3,881-94 ft., Tuscaloosa 4,077 ft., Paluxy 4,128 ft., elev. 91 ft.

ILLINOIS

East Omaha Pool May Be Revived By New Pay

MATTOON.—Illinois Oil Co. 1 Davis, NE NE SW 1-8s-8e, Gallatin County, on drill-stem test recovered gas, 15 ft. drilling mud, 15 ft. free oil, and 60 ft. of oil-cut mud, from Tar Springs at 2,115-27 ft. Pipe has been set at 2,115 ft. This test is located ¾ mile east of the discovery well of the East Omaha pool, which currently produces about 8 bbl. oil per day from the Levias at 2,853 ft. The Omaha pool, 3 miles to the west, produces from the Palestine at 1,680 ft., and Tar Springs at 1,880 ft.

Current development is giving the Browns pool of Edwards and Wabash counties a southeast extension. Latest completion which extends the pool another ¼ mile is Cherry-Kidd 1 Gray-Newman, NE NE SE 33-1s-14w, Wabash County, which was good for 150 bbl. from McClosky 2,992-3,000 ft. The Potter-Reeves-Lobree 1 BeDell, SW SW NW 34-1s-14w, a northeast offset to the Gray-Newman well, has pipe set on top of McClosky at 2,995 ft. The George-Wrather 2 Messman SW SE NE 33-1s-14w, swabbed 4 bbl. of oil per hour from McClosky at 2,994-3,002 ft. and No. 3 Messman SE SE NE 33-1s-14w, is drilling at 2,260 ft. S. C. Yingling 1 Crackel, NW NW SW 34-1s-14w, is a location.

ILLINOIS SUCCESSFUL WILDCAT

Effingham County: Gulf Oil Corp. 1 Schultz, SW SW NW 32-7n-7e, IP 48 bbl., McClosky 2,730-38 ft., TD 2,884 ft., PB 2,826 ft., Barlow 2,465 ft., Aux Vases 2,658 ft., Ste. Genevieve 2,718 ft.

ILLINOIS WILDCAT FAILURES

Edwards County: Magnolia Petroleum Co. 1 Langford, NE NW SW 3-1s-14w, dry at 3,069 ft., Glen Dean 2,410 ft., Barlow 2,614 ft., Aux Vases 2,902 ft., McClosky 3,009 ft.

Lawrence County: George-Wrather 1 Townsend, NW SE SE 30-2n-11w, dry at 2,100

ft., Glen Dean 1,594 ft., Barlow 1,741 ft., Renault 1,948 ft.

Hancock County: Dale E. Lambert 1 Griffiths, NW SE NE 26-7n-8w, elev. 696 ft., dry at 1,100 ft., Devonian 677 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR Bureau of Land Management, Washington 25, D. C. Notice is hereby given that sealed bids will be received until 1 p.m., Wednesday, May 14, 1947, for lands described herein situated within the known geologic structure of the designated oil and gas fields (undefined), in Louisiana. This land is offered to qualified bidders of the highest cash amounts per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act of February 25, 1920 (41 Stat. 437, 30 U.S.C. sec. 181), as amended, in the following parcels: Monroe gas field, Parcel No. 1, T. 18 N., R. 4 E., sec. 24, fractional lot 3, 9.24 acres. Parcel No. 2, T. 19 N., R. 5 E., sec. 10, SE¼SE¼, 40 acres. Parcel No. 3, T. 20 N., R. 5 E., sec. 34, SE¼ SE¼, 40 acres. Parcel No. 4, T. 19 N., R. 5 E., sec. 13, SW¼SE¼, 40 acres. Bethany gas field, Parcel No. 1, T. 15 N., R. 16 W., sec. 6, fractional NE¼NE¼, 41 acres. Haynesville oil field, Parcel No. 1, T. 23 N., R. 8 W., sec. 6, fractional NW¼SW¼, 27.87 acres. Simsboro gas field, Parcel No. 1, T. 17 N., R. 4 W., sec. 9, E½NW¼, 80 acres. Lake Bistineau gas field, Parcel No. 1, T. 16 N., R. 10 W., sec. 4, lots 5, 6, 7, 8, 88.34 acres. Parcel No. 2, T. 16 N., R. 10 W., sec. 22, NW¼ SE¼, 40 acres. Red River-DeSoto oil and gas field, Parcel No. 1, T. 12 N., R. 11 W., sec. 10, W½SW¼, 80 acres. Parcel No. 2, T. 12 N., R. 12 W., sec. 10, SW¼NE¼, SE¼NW¼, 80 acres. Sarepta-Cartersville oil and gas field, Parcel No. 1, T. 22 N., R. 11 W., sec. 2, lot 2, 7.28 acres. Parcel No. 2, T. 22 N., R. 11 W., sec. 4, lot 4, 6.72 acres. Parcel No. 3, T. 22 N., R. 11 W., sec. 5, lots 3, 4, 13.68 acres. Parcel No. 4, T. 23 N., R. 11 W., sec. 31, SE¼NW¼, 40 acres. Elm Grove oil and gas field, Parcel No. 1, T. 16 N., R. 12 W., sec. 36, lots 6, 7, 8, 48.52 acres. Shreveport oil field, Parcel No. 1, T. 17 N., R. 14 W., sec. 4, lot 7, 21.38 acres. Parcel No. 2, T. 17 N., R. 14 W., sec. 4, lots 8, 9, 10.76 acres. Parcel No. 3, T. 17 N., R. 14 W., sec. 4, lot 10, 11.12 acres. Parcel No. 4, T. 17 N., R. 14 W., sec. 6, lots 4, 5, 79.45 acres. Parcel No. 5, T. 17 N., R. 14 W., sec. 6, lot 6, 21.09 acres. Parcel No. 6, T. 17 N., R. 14 W., sec. 8, lot 1, 1.24 acres. Parcel No. 7, T. 18 N., R. 14 W., sec. 14, lot 18, 3.23 acres. Parcel No. 8, T. 18 N., R. 14 W., sec. 20, lot 9, 21.00 acres. Parcel No. 9, T. 18 N., R. 14 W., sec. 30, lot 5, 28.68 acres. Parcel No. 10, T. 18 N., R. 14 W., sec. 32, E½NE¼, 80 acres. Parcel No. 11, T. 17 N., R. 15 W., sec. 12, lot 1, 24.38 acres. Parcel No. 12, T. 18 N., R. 15 W., sec. 24, lot 7, 5.67 acres. Parcel No. 13, T. 18 N., R. 15 W., sec. 24, lots 8, 9, 10, 11, 12, 105.81 acres. Parcel No. 14, T. 18 N., R. 15 W., sec. 36, lots 1, 2, 3, 3.89 acres. Pine Island oil field, Parcel No. 1, T. 21 N., R. 15 W., sec. 10, E½NE¼, 80 acres. Rodessa oil field, Parcel No. 1, T. 23 N., R. 16 W., sec. 2, fractional SW¼NE¼, 27.96 acres. Royalties payable to the United States will be at the rate of 12½ per cent to 25 per cent for oil and 12½ per cent to 16 2/3 per cent for gas, in accordance with Schedule B in the lease form. Bids must be submitted on each parcel separately, but no objection will be made to the award of more than one parcel to the same successful bidder. All bids must be submitted to the Director, Bureau of Land Management, Washington 25, D. C., and each bidder must submit with the bid one fifth of the amount bid in cash or by certified check on a solvent bank, or by money order, made payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease, required under 43 CFR 192.42(b) and (c). The envelopes should be plainly marked "Bid for Parcel No. . ., (name field). Not to be opened before 1 p.m., May 14, 1947." No bids received after the hour fixed herein for receiving bids will be considered. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid, and a corporate surety bond in the sum of at least double the amount of rental but in no case less than $1,000 nor more than $5,000 must be furnished by a successful bidder prior to the issuance of a lease. The deposits of the other bidders will be returned upon acceptance of the successful bids. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids. Fred W. Johnson, Director.

New Conditions Face Natural-Gas Industry

(Continued from page 41)

motor fuels of lower volatility, thus automatically creating a greater market for the volatility of natural gasoline, G. G. Oberfell and R. C. Alden, Phillips Petroleum Co., stated. The trend of the last 15 years toward more and more volatile refinery gasoline will be reversed, apparently, and the situation may reverse also the tendency to make the highest octane-number natural, the most volatile grades, sell for the lowest price.

These authors doubt that the total volatility of motor fuels in the immediate future will become less volatile, even with the addition of the less-volatile, high-boiling catalytically cracked fuel components. Several developments tip the scales in the direction of greater, or maintained, volatility; growth of the distillate industry points to addition of larger amounts of volatile material to the total motor-fuel supply; the octane race may cause refiners to make still more volatile straight-run gasolines—in reforming heavy naphthas more to increase octane ratings—and the reforming operation itself will make more volatility. Increasingly severe thermal-cracking operations will make for higher volatile gasoline. Conversion of C_3 and C_4 by polymerization, alkylation and similar operations may be expected to continue and expand, bringing higher volatility.

Many other factors will affect pro and con the matter of motor-fuel volatility, factors such as solvent and other naphthas, kerosenes, light distillates, chemical synthesis, and fuel-market demands. Straight-run gasoline has been reduced from about 80 per cent of the total motor fuel output in 1918 to about 38 per cent in 1946, the authors stated. Use of natural gasoline and "distillate" has been increasing at about the same rate as straight-run has decreased. Polyform fractions, catalytic "poly," and alkylate gasolines now form about 8 per cent of the total production and these portions may be expected to increase. Since probably half the remaining 42 per cent of motor fuel is thermal and catalytic-cracked product of which probably half is catalytic, this 20 per cent fraction is about the only portion which will become less rather than more volatile.

Wider variations in volatility in motor fuels from different sources may be expected in the immediate future, these authors indicated. Refiners with no source of catalytic-cracked fuels of lower volatility and higher octane rating may be forced to increase rather than decrease volatility in order to obtain the increased octane rating by adding high-octane-number volatile fractions. The automotive engineer apparently must build an engine which will operate satisfactorily on fuels of much greater volatility range than was the case prewar.

Of increasing importance is the emphasis placed on the range or variation between A.S.T.M. and Research octane ratings. The processes which make for greater "jump" between these two ratings are catalytic and thermal-cracking, reforming, polyforming, and catalytic polymerization, all of which show large differences between these two ratings.

Straight-run and natural gasolines, distillates, and alkylates produce low differences between these ratings. They constitute some 53 per cent of the motor-fuel supply and except for alkylate are the lowest in manufacturing costs. Since this "low jump" fuel material must be consumed, and since the automotive engineers must build systems which will operate satisfactorily on fuels containing them, the situation demands the greatest degree of cooperation between the automotive and refining industries, the authors emphasized.

Joint Project Suggested

Present considerations of the need for consumption of larger quantities of volatile fractions "suggest a joint enterprise for the automotive, refining, and natural-gasoline industries, in the form of development of high-compression truck and bus engines and the necessary transportation . . . facilities" for fuels of much greater volatility (vapor pressure) to take advantage of both this vapor pressure and the much higher octane ratings of fuels of 30-lb. Reid vapor pressures. Ethane, propane, and excess butanes may be converted to motor fuels of conventional volatilities by the more recently developed processes for gas conversion such as isomerization, gasoline synthesis of the Fischer-Tropsch type, polyforming, and alkylation. The average gasoline plant may have as high as five times as much charge stock of the C_2-C_4 range as it makes of 26/70 fuel, and an assembly of gasoline-plant light material of 4,000 bbl. per day may make one of these gas-conversion processes economical, the authors believe. It is a grave mistake for people to delude themselves by considering that octane number is the sole important property of a motor fuel, since volatility affects its performance quite as much as does antiknock quality, it was indicated. It is probable that charge stock for relatively large units for gas conversion to motor fuels may be assembled economically in the future, with long advantage to the industry, they stated.

Among the

Drilling Contractors

Long Beach Host City Of Drillers' Convention

LONG BEACH, Calif., will be the scene of the seventh annual convention of the American Association of Oilwell Drilling Contractors on October 13-15. This was announced officially Tuesday, April 22, at a luncheon meeting of oil men and Long Beach city officials at the Pacific Coast Club at Long Beach.

Purpose of the meeting was to announce officially to the city of Long Beach the coming of the convention. Following the announcement, the city officials extended a welcome to the contractors and expressed the belief that the coming convention will be one of the most successful in the history of the organization.

A committee of California contractors was appointed at the meeting to supervise preliminary arrangements for the yearly conclave. Appointed as chairmen of some of the various committees were: Tom Pike, technical committee; Doug Graham, publicity and housing committee, and Dick Pettijohn, food committee.

A special feature of the convention, it was announced, will be a paper on the fine art of directional drilling which has been developed at Long Beach. This paper will be prepared and presented by petroleum engineers of the Long Beach Harbor Commission.

Presiding at the meeting was E. L. Decker, of Martin-Decker Co. Attendance included many prominent California contractors, Long Beach city officials, and executives of many of the California oil companies. Brad Mills, executive secretary of the association, flew from Dallas to attend the meeting.

Smith-Horton Drilling Co., Tulsa, was to start a 6,500-ft. Wilcox test at the 1 Anderson, in NE NE SE 14-18n-3w, Logan County, Oklahoma. The materials were being moved in for the test, which is 4 miles southwest of Mulhall. Nearest production is in Northeast Crescent pool, 5 miles southwest.

Commonwealth Drilling Co., of Calgary, has contract for Command-Globe 2, NE LSD 8, 15-27-27w3, in the southeastern section of Lloydminster field.

Muskegon Development Co. has been awarded drilling contract on the Chapman Oil Co. 2 Martha Wendt, in C N½ SW SE 34-15n-4e, Bay County, Michigan.

Virginia Drilling Co. was drilling ahead below 2,700 ft. at its 1 Laudick,

Fleet Drilling Co. crew at Sinclair Prairie Oil Co. 2 Wayne, in Garvin County, Oklahoma. The men are: Herbert Hermon; W. M. Vaden; Varon Tilly; Jim Gilmore, driller; Dink Morris, toolpusher; John E. Millar, geologist for Sinclair Prairie; Charles Werner, mechanic

PENBERTHY

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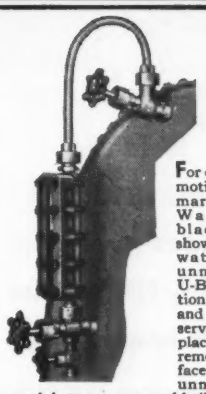

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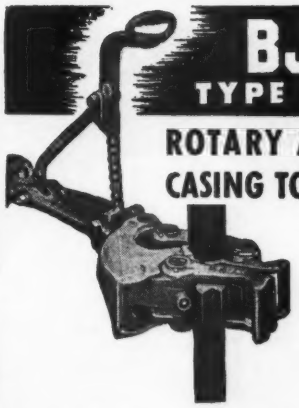

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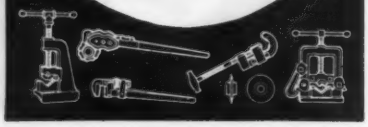

in NW NW SE 10-21-12, Stafford County, Kansas. The well is 1½ miles northwest of Saundra pool. Phillips Petroleum Co. farmed out the west half of the southeast quarter and the east half of the northwest quarter of Section 10 and is supporting the test.

J. R. Nowery Drilling Co. is contractor on the Hewitt & Dougherty 1 Cook Land Co., wildcat northeast of Pleasant Hill, in DeSoto Parish, Louisiana. Location is in C NW SW 16-10n-11w. Well was rigging up for a Pettit test.

Jackson & Son Drilling Co. was starting at the 2 Schick, in SE SE NE 27-1s-8w, Stephens County, Oklahoma. The test is scheduled to go to 2,000 ft.

General Petroleums, of Calgary, Alta., has received from Continental Oils the contract for Continental S.L. 1, LSD 13, 30-46-26w3, in western Saskatchewan south of Lloydminster field. This is the first of a series of wells to be drilled on both sides of the Alberta-Saskatchewan boundary.

R. Benton Ross Drilling Co. and Walter Duncan were moving in at the 1-B Oma Dugan, in SW SE SW 5-5s-12w, south of Randlett, in Cotton County, Oklahoma. The contract is for 2,000 ft.

Triangle Drilling Co. will use its own tools in drilling the 1 Fisher, a wildcat test in SW SW 10-14n-15w, north of Keatchie, in DeSoto Parish, Louisiana. The test is scheduled to go to 4,000 ft.

Mallard Drilling Co. will drill three tests for J. C. Dozier and National Cooperative Refinery Association in the north end of Edwards pool, in Ellsworth County, Kansas. Locations have been staked and tools were to be moved in at once for the 7 Janssen, in NE SW NE 21-17-8. Two other locations are the 1 Janssen, in NE NW NE 21-17-8, and the 4 Williams, in NE SW NW 28-8-17.

Brown Drilling Co., of Long Beach, has spudded in Standard Oil Co. C-2 at Huntington Beach, and is rigging up for a test by the same company near Davis, in Yolo County, California. In addition to these tests, the Brown company has four other strings of tools operating in California and two in Saudi Arabia.

Clyde Hall Drilling Co. has been awarded contract to redrill the 22 Derby in Mountain View field of Kern County, California, for Lloyd S. Gilmour. This same company also has the contract to drill the Gilmour 54 Corey, 13-30s-28e, also in Mountain View field, for which location has already been staked.

C. E. "Doc" O'Neal has drilling contract on the E. A. Gabriel 1 Hugh Fleener, in 22-3s-12w, Gibson County, Indiana. Rotary tools will be used.

E. C. Norwood Drilling Co. was drilling below 4,270 ft. at its 1 O. H. Dodson, Hardeman County, Texas, wildcat in Section 4, Block 10, H&TC Survey, 3 miles north of Chillicothe.

A. F. "Al" Lutgans is drilling contractor on the Tri-State Oil Syndicate 1 R. McClure, in Sullivan County, Indiana.

Karel & Federspiel, of Lloydminster, Alta., are nearing completion of Ace 1, NE LSD 6, 35-48-28w3, in the Saskatchewan portion of the Lloydminster field.

Severens Drilling Co. has the contract for the 1 Park Community, a new venture projected for the Alondra Park area of Los Angeles County, California, by British-American Oil Producing Co. and The Texas Co. The well will be whipstocked from 22-3s-14w.

Camay Drilling Co. has completed 5 Dollie for Adams Oil Co. in the Edna-Arroyo Grande area of San Luis Obispo County, California, and is now putting the finishing touches on the 6 Dollie. Upon completion of this well, the company will move on to drill the 7 Dollie.

Herndon Drilling Co. was making hole below 3,360 ft. at the 1 Overholzer, in NW NW NW 31-9-16, 2 miles south of Westhusin pool, in Rooks County, Kansas.

Gilliam-Aspin Drilling Co., Evansville, Ind., has been dissolved as of April 1. J. H. Gilliam and Harold Aspin each will continue to operate in the Illinois-Indiana area.

S. S. Hoyman is contractor on the Butler & Sons 1 Lowery, in 7-20n-15w, Caddo Parish, North Louisiana. This will be a Chalk test in the Caddo pool.

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GIDDENS-LANE BUILDING

SHREVEPORT, LA.

Shaw Petroleums, of Lloydminster, Alta., is finishing the drilling of West End 2, NE LSD 16, 10-50-2w4, in the northwest extension of the Lloydminster field.

Anderson Drilling Co. was starting the 1 J. L. Rhoades, in SE NE SE 12-1s-10w, 1½ miles east of Hulen and about the same distance north of Walters field production, in Cotton County, Oklahoma. Contract is for 2,500 ft.

T. P. Pike Drilling Co. is rigging up to redrill the Macco-Beloil Corp. 2 Fee, 28-2s-14w, in the Potrero field of Los Angeles County, California. This well was originally Richfield Oil Corp. 1 Coffin, and is presently bottomed at 6,508 ft.

Exploration Drilling Co. was moving in rig to start its 1 Guy E. Gabbart, 4,500-ft. rotary wildcat on the western edge of Jones County, Texas, 4 miles southeast of McCaulley. The location is 330 ft. from north and east lines of the west half of Section 360, Goliad County School Lands.

Penrod Drilling Co. is contractor on the Nelson B. Hunt 1 Nebo Oil Co., in C SE NW 33-16n-7w, a projected 7,500-ft. wildcat test in Bienville Parish, North Louisiana. Location is 3 miles south and 1 mile west of Sparta. Work was to start at once.

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DELTA No. 1—1 swivel, ⅜ or ½" chain
DIXIE No. 1—2 swivels, ⅜ or ½" chain
LONE STAR 1—2 swivels, ⅜, ½ or ⅝" chain
LONE STAR 2—2 swivels, ⅜, ½ or ⅝" chain

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George Livermore has contract to deepen the 1 Mullis, which Richfield Oil Corp. has acquired from Honolulu Oil Corp. et al in 21-15s-29e, Chaves County, New Mexico. The well has been shut down at 10,033 ft. in lime. Contractor was moving in.

Woods Drilling Co., New Orleans, has drilling contract and 50 per cent interest in a well to be drilled to 5,500 ft. in 6-5s-2w, Carter County, Oklahoma, for Franklin, Aston, & Fair, of Ardmore, Okla.

Meredith, Clegg, & Hunt, Houston, are rigging up on a 9,200-ft. contract to drill Fidelity Oil & Royalty Co. 1 Brown, in the Sugar Valley field of Matagorda County, Texas.

Byerly Drilling Co., Vivian, La., has contract to drill the J. E. Muth et al 1 Christian Church, a shallow test in 1-20s-16w, Caddo Parish, Louisiana.

Carl Brooks, Oil City, La., will drill J. E. Muth's 1 Reed Woodward, in 1-20n-16w, Caddo Parish, Louisiana.

Parker Drilling Co. of Canada, with head office at Tulsa, has been registered in Alberta. The company has the contract for Gulf 1 deep test, LSD 15, 24-3-29w4, in the Pincher Creek area of southeastern Alberta.

Wheeless Drilling Co. is contractor on the Arkansas Fuel Oil Co. 8-B DeLoach, in 22-23n-8w, Claiborne Parish, Louisiana. This will be a test to the Smackover. It is in the Haynesville deep pool.

Trand Phillips Drilling Co. has been awarded contract to drill the Humble Oil & Refining Co. 1 Rio Oil Corp., wildcat in the Jesse Walker Survey, Wood County, Texas. Location is 4 miles east of Yantis. Contract is to the Travis Peak.

Warren-Bradshaw Drilling Co. was moving out rig and fighting inclement weather at the Skelly Oil Co. 1 Adams, in C SW SE 20-13n-2w, ½ mile south of the discovery gas well of Witcher field in Oklahoma County, Oklahoma.

Regent Drilling Co., Ltd., Vermilion, Alta., has been awarded a contract from Globe Dillon Syndicate on the 174,000 acres in the Blackfoot Indian Reserve. The well will be drilled on the Crowfoot anticline.

Robert W. Atha will drill on contract the Gulf Refining Co. 3 E. A. Leonard, in C N½ NE NW 3-14n-4e, Bay County, Michigan. Atha will also drill the Mogue Oil Co. 1 Peter Dent "A," in C N½ SW NE 5-15n-6w, Isabella County, Michigan.

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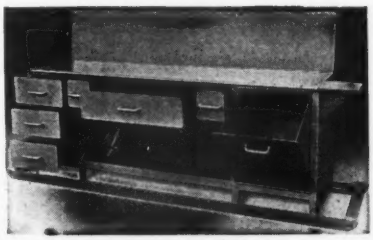

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STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 26, 1947

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1947				
	Comp.	Oil	Gas	Dry	Footage	1947	1946	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	19	9	0	*10	27,531	414	501	0	0	0	0	0	3	0	0	2	5
Pennsylvania	46	23	4	†19	71,266	968	1,283	0	0	0	0	0	0	0	0	0	0
West Virginia	15	1	10	4	38,416	256	222	0	0	0	0	0	0	0	1	0	1
Ohio	22	5	11	6	48,883	390	352	0	0	0	1	1	0	0	2	17	19
Indiana	13	5	1	7	25,011	176	98	1	0	0	0	1	5	0	0	13	18
Kentucky	17	10	2	5	26,064	155	141	0	0	0	3	3	5	0	0	14	19
Illinois	37	22	0	15	99,613	§603	655	1	0	0	3	4	19	0	0	82	101
Michigan	7	4	1	‡2	16,201	177	211	1	0	0	0	1	3	0	4	58	65
Kansas	39	13	8	18	131,323	794	623	0	0	0	7	7	12	0	7	85	104
Neb., Mo., Iowa	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	2	2
Oklahoma	52	23	4	‡25	170,759	1,272	750	0	0	0	10	10	26	2	3	231	262
Texas	192	139	5	48	885,769	2,650	2,515	11	0	0	25	36	93	16	24	399	532
North Central (Dist. 7B & 9)	69	47	2	20	189,670	§831	861	3	0	0	6	9	37	0	5	135	177
West (Dist. 7C & 8)	49	47	0	2	233,955	624	537	2	0	0	1	3	10	0	2	45	57
Panhandle (Dist. 10)	2	2	0	0	6,638	136	122	0	0	0	0	0	1	0	1	0	2
Eastern (Dist. 5 & 6)	8	6	1	1	54,566	155	238	1	0	0	3	4	2	0	1	37	40
Gulf Coast (Dist. 3)	33	19	1	13	228,809	503	572	3	0	0	7	10	21	11	10	85	127
Southwest (Dist. 1, 2 & 4)	31	18	1	12	172,131	401	185	2	0	0	8	10	22	5	5	97	129
Louisiana	21	12	0	9	122,071	365	404	0	0	0	3	3	12	7	2	50	71
Northern	12	6	0	6	31,952	177	206	0	0	0	1	1	0	0	0	29	29
Southern	9	6	0	3	90,119	188	198	0	0	0	2	2	12	7	2	21	42
Arkansas	0	0	0	0	0	73	58	0	0	0	0	0	0	0	0	12	12
Mississippi	9	8	0	1	73,547	110	77	0	0	0	1	1	0	0	1	24	25
Southeastern States	0	0	0	0	0	15	14	0	0	0	0	0	0	0	0	13	13
Montana	6	5	0	1	12,524	52	79	0	0	0	0	0	0	0	0	8	8
Wyoming	8	5	1	2	43,689	68	54	2	0	0	0	2	6	0	1	12	19
Colorado-Utah	2	2	0	0	12,455	54	40	0	0	0	0	0	1	0	0	9	10
New Mexico	16	13	3	0	87,976	166	123	1	0	0	0	1	4	0	1	12	17
California	44	36	0	8	191,510	621	585	2	0	0	5	7	16	0	0	92	108
Total United States	565	335	50	180	2,084,608	9,381	8,790	19	0	0	58	77	205	25	46	1,135	1,411
Total previous week	537	293	56	188	1,821,295	8,816	8,259	11	0	2	52	65	186	25	46	1,077	1,334
Total April 27, 1946	531	307	47	177	1,762,566			16	2	1	57	76	161	16	38	991	1.206

Service wells included: *10, †19, ‡1. §Revised.

CRUDE PRICES AND REFINERY ACTIVITY

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.40	....	....	....
19-19.9	1.45	....	....	....
20-20.9	1.49	$1.55	....	$1.42
21-21.9	1.53	1.57	....	1.44
22-22.9	1.57	1.59	....	1.46
23-23.9	1.60	1.61	....	1.48
24-24.9	1.64	1.63	$1.86	1.50
25-25.9	1.68	1.65	1.88	1.52
26-26.9	1.71	1.67	1.90	1.54
27-27.9	1.75	1.69	1.92	1.56
28-28.9	1.79	1.71	1.94	1.58
29-29.9	1.82	1.73	1.96	1.60
30-30.9	1.86	1.75	1.98	1.62
31-31.9	....	1.77	2.00	1.64
32-32.9	....	1.79	2.02	1.66
33-33.9	....	1.81	2.04	1.68
34-34.9	....	1.83	2.06	1.70
35-35.9	....	1.85	2.08	1.72
36-36.9	....	1.87	2.10	1.74
37-37.9	....	1.89	2.12	1.76
38-38.9	....	1.91	2.14	1.78
39-39.9	....	1.93	2.16	1.80
40 and above	....	1.95	2.18	1.82

*For crude from Daboval, El Campo, and Sandy Point. †Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT, WEEK ENDED APRIL 19

(Thousands of barrels)

District—	Crude runs, daily avg.	Production				Stocks at refineries, bulk terminals, in transit and in pipe lines			
		Gasoline†	Kerosene	Gas & dist. oil	Residual	Gasoline*	Kerosene	Gas & dist. oil	Residual
East Coast	855	1,794	296	1,199	1,736	22,334	4,196	8,785	6,266
Appalachian:									
District 1	92	263	50	80	83	2,637	178	332	233
District 2	65	212	17	49	92	1,101	41	69	76
Ind., Ill., Ky.	711	2,421	316	798	922	22,322	1,160	2,452	1,775
Okla., Kans., Mo.	369	1,272	162	443	462	10,386	315	1,164	901
Inland Texas	219	1,010	112	104	375	4,326	215	289	709
Texas Gulf	1,009	3,006	574	1,379	1,347	14,923	1,390	5,355	5,117
Louisiana Gulf	385	1,128	330	374	399	5,794	646	1,839	1,422
N. La. and Ark.	60	162	41	65	88	2,056	216	427	106
Rocky Mountain:									
New Mexico	11	36	5	8	18	80	16	35	57
Other	126	390	24	143	221	3,046	57	493	626
California	807	2,272	80	621	2,218	16,587	878	10,230	25,459
April 19, 1947	4,709	13,966	2,007	5,263	7,961	105,592	9,308	31,470	42,749
April 12, 1947	4,667	14,090	2,011	5,499	8,232	106,221	9,236	32,019	42,946
April 20, 1946	4,781	13,784	2,130	5,324	9,048	100,672	11,065	31,384	37,017

*Finished and unfinished. †At refineries including natural blended.

Bureau of Mines crude-oil stocks 234,051,000 bbl. as of April 19—up 2,505,000 bbl. One year ago 221,689,000 bbl.

FLAT CRUDE PRICES

Representative posted schedules per bbl.

East Texas	$1.95	Illinois Basin	2.07
Kettleman Hills, California*	1.94	Pecos County, Texas (Yates)	1.65
Beauregard Parish	1.90	Bradford, Pennsylvania	3.91
		Eastern Ill. and Western Ind.†	2.07
		Tomball, Texas Gulf Coast	2.10

*37°-37.9°. †35° and above.

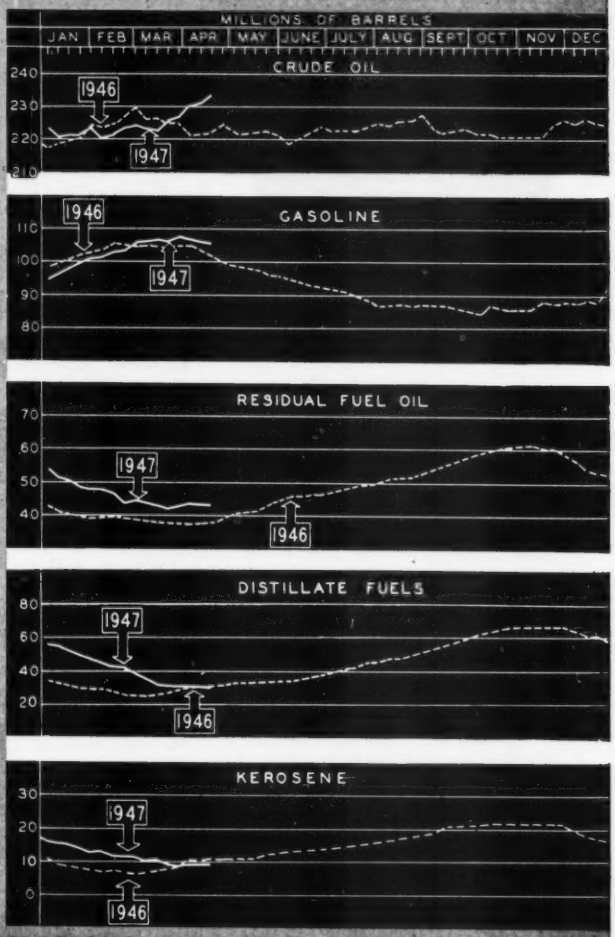
TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

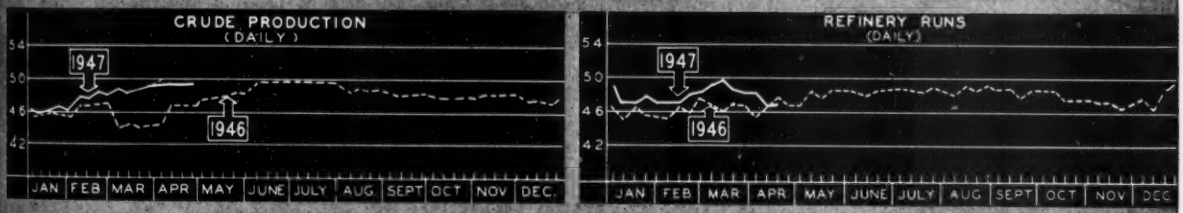
	Apr. 26 crude oil	B. of M. Apr. demand	Apr. 19 crude oil
Alabama	350	1,200	400
Arkansas	80,100	79,000	80,850
California	910,750	860,000	907,500
Colorado	39,010	38,000	38,110
Eastern	64,500	65,200	65,000
Florida	550	200	550
Illinois	185,300	210,000	186,300
Indiana	18,000	18,000	18,200
Kansas	281,200	275,000	278,450
Kentucky	25,500	29,000	24,600
Louisiana	416,155	410,000	415,355
North Louisiana	103,550	.....	102,750
South Louisiana	312,605	.....	312,605
Michigan	40,230	47,000	42,140
Mississippi	86,890	84,000	85,540
Montana	23,290	24,000	23,060
Nebraska	600	700	600
New Mexico	103,155	102,000	103,155
Oklahoma	386,450	380,000	376,900
Texas	2,150,545	2,120,000	2,150,545
Dist. 1 (Southwest)	20,664	.....	20,664
Dist. 2 (Southwest)	157,957	.....	157,957
Dist. 4 (Southwest)	241,971	.....	241,971
Dist. 3 (Gulf Coast)	483,443	.....	483,443
Dist. 5 (Eastern)	38,147	.....	38,147
Dist. 6 (Eastern)	111,284	.....	111,284
East Texas field	325,571	.....	325,571
Dist. 7C (West)	35,697	.....	35,697
Dist. 8 (West)	480,710	.....	480,710
Dist. 7B (W. Central)	36,768	.....	36,768
Dist. 9 (N. Central)	133,543	.....	133,543
Dist. 10 (Panhandle)	84,790	.....	84,790
Wyoming	113,110	106,000	112,630
Miscellaneous	.....	700	.....
Total United States	*4,925,685	4,850,000	4,909,885
Change from prev. wk., up	15,800		

Total production January 1-April 26..... †559,117,595 bbl.
Same period last year (crude plus cond.).. 539,499,425 bbl.
*Not incl. 27,190 bbl. condensate. †Incl. 3,009,400 bbl. condensate.

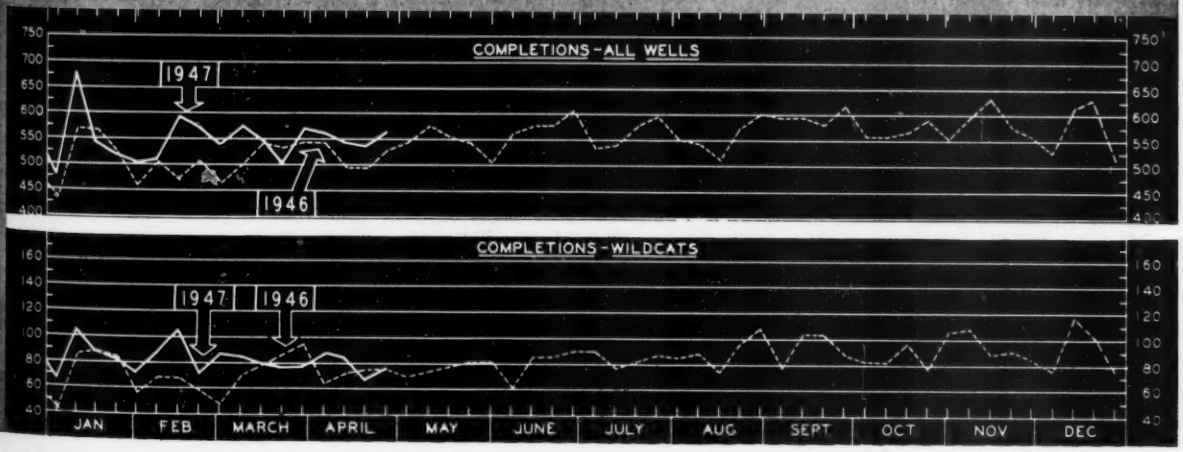
OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS



Solid line charts weekly completions, service wells in Eastern area included.



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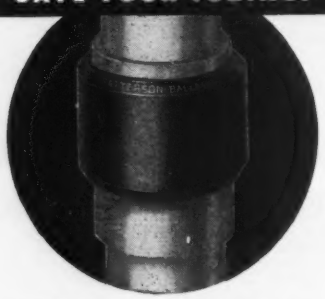
SAVE YOUR TUBING!



Tubing collars worn by contact with casing steal the profit out of pumping. Patterson-Ballagh Plastic Tubing Protectors prevent both collar and casing wear. Oil-proof, wear-resistant, insulating. They are pressed onto the collar under pressure and will not come off. Made in all sizes. End your tubing troubles. CALL in your Patterson-Ballagh man.

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FOR THE SAFETY OF YOUR MEN—

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Derrick-escape mechanism for sliding down a guy line from a derrick, or refinery tower

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EXTRA STURDY CONSTRUCTION
QUICKLY STRADDLED

POSITIVE, INSTANT BRAKE
BRONZE "No-Spark" SURFACES
FOR 5/16" to ¾" GUY LINES

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MARKETS

SPECULATION of an impending rise in products prices, particularly gasoline, was heard during the past week in a market marked by a strong demand, firm prices, and a shortage of many petroleum products.

While sales officials predicted there will be no automobiles stranded this summer by a critical shortage of gasoline, many agreed some distributors will find themselves occasionally with empty storage tanks and little or no motor fuel on hand.

That some suppliers are buying all gasoline available to them on the theory that even if not needed it will constitute a sound investment, based on the assumption that prices cannot fall and probably will increase, was a belief expressed in some quarters.

Over the nation from all quarters came assurances that the price of crude oil will not drop, mixed with demands that the price be increased further in order to encourage more exploration and subsequent development. Also heard were suggestions petroleum product prices have failed to keep pace with other common products of the nation and should be increased as an incentive to spur the search for more oil.

Generally there was no change in prices. All products remained tight. In the East, burner manufacturers protested that predictions of a fuel-oil shortage next winter were "over pessimistic."

The tank-car situation remained tight, with marketers registering disappointment as an expected loosening up failed to materialize. In Texas, however, a large midwestern refiner had appealed for an allowable increase of 15,000 bbl. daily in one field and declared in its petition sufficient tank cars were on hand to transport the additional crude. Observers estimated 1,200 tank cars would be involved in the proposal.

Residual fuel oil, where available, continued to bring a Group 3 price of about $1.95 and in some quarters major companies were reported allotting the product on a basis of 70 to 90 per cent of contract commitments.

The bulletin of the National Association of Purchasing Agents said the tight residual supply might be attributed "to a sustained high industrial demand and the ever-increasing demand on the part of many coal consumers to supplant their solid fuel with fuel oil." "Export shipments," the report said, "as well as maritime and navy consumption, continue at high levels." At the same time, it pointed out, many refiners have allowed their percentage yield of residual to fall below 20 per cent with a corresponding gain in gasoline output.

Gasoline inventories remained considerably below normal as the industry looked forward to what promised to be a record demand year for the product. Natural-gasoline supplies remained jubilant as a seasonal drop in demand for their product failed to occur and prospects were bright for a continued strong demand with accompanying high prices.

In Canada, Imperial Oil, Ltd., and Royalite Oil Co., Ltd., announced increases in the prices of components of absorption gasoline, increasing isobutane 65 cents per bbl. and the 26-lb. R.v.p. product by 75 cents per bbl. New prices included: propane, $0.40 per bbl.; isobutane, $1.45; normal butane, exclusive of that contained in the 26-lb. product, $0.40; and 26-lb. R.v.p. product, $3.63.

Representative Quotations

Representative spot-market quotations of leading suppliers as of last Monday. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel.

GASOLINE, KEROSENE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor	Texas Gulf Coast
Regular gasoline, 73-75 octane	8-8.5	10.1-10.4* 9.2- 9.4†	7.75-8
Premium gasoline, 78-80 octane	8.75-9.5	10.2-12	8.5 -9
42-44 w.w. kerosene	6.875-7.25	7.8	6.75-6.875
No. 2 straw fuel oil	6.125-6.625	6.8-6.9	5.5-5.75
No. 6 residual	$1.80-1.95	$2.22	$1.55-1.70

*Branded (74-76 octane); †Unbranded (74-76 octane).

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.375	4.875	5.125
Grade 18-55	6.45	5.85	6.15

LUBRICATING OILS

Mid-Continent

150-160 vis. D bright stock, 0-10 p.p.	29
200 vis. No. 3 neutral, 0-10 p.p.	18-20

South Texas

200 vis., No. 2-3 neutral	11-12.5
750 vis., No. 3-4 neutral	13-15.25
2,000 No. 5-6 neutral	14.5-16.75

Western Pennsylvania

145-155 vis. 10 p.t. bright stock	43
180 vis. 0 p.t. neutral	43

The Sheriff Wears A

CAXTON *Forty*

SILVER BEAVER

Sheriff "Hoss" Anderson of Montgomery County, Texas, shown wearing a Caxton Model "Sheriff."

Ranchman from birth, cattle raiser, medal-winning soldier, "Hoss" Anderson is in line for new accolades as a guardian of the law. His reputation as a keen judge of good things is underscored by his preference for Caxton Hats.

Caxton Hats are made of the finest fur felts. Priced from ten to one hundred dollars each.

Sold in the Southwest by the following:

ARIZONA

Bisbee—W. F. Holway
Casa Grande—Skipper's
Coolidge—Mirkin's
Flagstaff—Bledsoe's Man's Shop
Glendale—Gene Summer's Men's Shop
Kingman—Alex's Toggery
Lowell—Kobey's Man's Shop
Mesa—Friedie's
Eloy—The Broadway
Cameron—Cameron Trading Post
Phoenix—Brown's
Prescott—Caro's
Safford—J. Green
Tucson—Andy Anderson, Ltd.

LOUISIANA

Monroe—Joe F. Smith & Co.
Natchitoches—Lieber's
New Iberia—The Model Co.
New Orleans—Rex Hat Co.
Leon Godchaux Clothing Co.
Opelousas—Harry Tankel
Shreveport—Jordan & Booth
West Monroe—Joe F. Smith & Co.

NEW MEXICO

Alamogordo—The Men's Store
Albuquerque—E. L. Washburn Co.
Brown's
Bayard—The Fashion
Carlsbad—M. Vorenberg Co.
Clayton—Herzstein's
Clovis—Jack Holt Clothiers
Corona—Roberts Mercantile Co.
Deming—Tidmore
Farmington—Knox Men's Store
Fort Sumner—O. A. Teeter & Sons
Gallup—P. Mlocher Co.
Grants—Huxford & Filleman
Hanover—Thomas M. Rivera
Hatch—Crout's
Hobbs—Dunlap's
The Crown Store
Hot Springs—The White House
Las Cruces—Popular Dry Goods Co.
Las Vegas—Hoffman & Graubarth, Inc.
The N. T. Store
Roswell—Jay Duvall
Ruidoso—The Westerner
Santa Fe—Goodman's
Santa Rita—The Santa Rita Store
Santa Rosa—O. A. Teeter & Son
Tularosa—R. D. Champion Store
Wagon Mound—Vorenberg Mercantile Co.

OKLAHOMA

Carnegie—Dixie Store
Clinton—Simon's Dept. Store
Coweta—Kraker Bros.
Enid—S. & Q. Clothiers
Erick—The Dixie Store
Hobart—J. Slaner
Muskogee—S. & Q. Clothiers
Oklahoma City—Stockyards Saddlery Co.
Anderson Bros.
Barth Bros. Co.
Ryan—The Snappy
Shawnee—The Man's Store
Stillwater—Chrisman and Ross
Sulphur—John Hassen Dept. Store
Texhoma—Dodson Dry Goods
Tulsa—Clarke's Good Clothes
Wagoner—Kraker Bros.
Weatherford—Levine & Miller

TEXAS

Abilene—Thornton's Dept. Store
Alpine—Forchheimer's
Alto—Tom Williams
Amarillo—The Hub
Austin—Hutchins Bros.
Baytown—Bernstein's
Bonham—Leatherwood & Arledge
Borger—The Hub
Brackettville—Petersen Company
Brady—Samuel's Dept. Store
Brownwood—Waisman's Dept. Store
Cisco—F. N. Hassen
Conroe—Gentry's
Corpus Christi—Capitol Outfitters
Cotulla—Ben's
Crane—Leaman's
Crockett—Ferguson's Man's Shop
Del Rio—The Star Store
Dimmitt—Snipe's Shop
Eden—A & B Men's Wear
Edinburg—Brumley-Thomson
El Paso—Popular Dry Goods Co.
Fort Stockton—N. Winkler & Sons
Fredericksburg—Stehling Bros.
Galveston—Leopold-Shafer Co.
Gladewater—Palace Clothiers
Goliad—Cole Dry Goods Co.
Gonzales—J. Q. Short
Graham—Shabay Men's Store
Greenville—Young's
Groveton—The Annex
Hallettsville—Meyerhoff Dry Goods Co.
Hamlin—D & H Dept. Store
Harlingen—The Man's Shop
Henderson—Crawford Clothiers
Honey Grove—Lane Bros.
Houston—Mosk's
Shudde Bros.
Italy—J. M. Coates
Junction—Joseph's Dept. Store
Kermit—N. Winkler & Sons
Kerrville—Wolfmueller's
Kilgore—Weinberg's
La Porte—Lynwood's
Linden—Allen Bros.
Lubbock—S & Q Store
Walton's
Lufkin—H. Abram & Son
Luling—Max Finkel
McAllen—The Man's Shop
Marfa—Philip's Dry Goods Co.
Matador—W. F. Jacobs
Midland—Dunlap's
Milford—J. M. Coates
Monahans—Dunlap's
Ozona—Lemmons Dry Goods Co.
Pampa—Lively's Man's Shop
Pecos—Sisk Dry Goods Co.
Perryton—The Men's Wear Store
Plainview—Corcorran's
Pleasanton—Miller's Dept. Store
Port Arthur—Roos Man's Shop
Ranger—The Globe
Raymondville—Rhone's Man Shop
Roby—D & N Dept. Store
Rocksprings—Shepperd's
Rotan—D & H Dept. Store
San Antonio—Hutchins Bros.
Sanderson—Shepperd's
Sherman—Pack Luna & Co.
Sierra Blanca—Guerra and Company
Stamford—D & H Dept. Store
Sterling City—Bailey Bros.
Sweeny—Anna's
Sonora—H & P Men's Store
Texarkana—Sampson's, Inc.
Tyler—Gold's Man's Shop
Victoria—M. O. Simon Co.
Wellington—Dodgin's Men's Store
Weslaco—Levine's Man's Shop
Yorktown—Cole Dry Goods Co.

Equipment Men in the News

Weyerman Organizes New Company

W. C. Weyerman, graduate chemical engineer from University of Texas with active engineering and sales engineering experience in the petroleum and chemical industries since 1939, has organized a new company, Wyco Equipment & Engineering Co., with offices at 3920 Fannin Street, Houston. The company represents several different manufacturers of refinery, gasoline-plant, and pipe-line equipment in Texas and Louisiana.

Raybestos-Manhattan Advances Matthews, Cilley, Heinsohn

At the annual stockholders' meeting of Raybestos-Manhattan, Inc., held at Biltmore Hotel, New York City, April 1, 1947, and at the directors' meeting immediately following, two vice presidents and a director were added. Those included in these promotions are: John H. Matthews, elected vice president in charge of the Manhattan Rubber Division, Passaic, N. J.; O. H. Cilley, assistant general manager of the United States Asbestos Division, Manheim, Pa., was made a vice president; A. F. Heinsohn, general manager of General Asbestos and Rubber Division, North Charleston, S. C., was placed on the new board of directors.

Black Hills Bentonite Constructs New Plant

Black Hills Bentonite, Inc., has commenced construction on its new bentonite plant located at Moorcraft, Wyo. It expects to be in operation by June 1, and will manufacture bentonite for oil-well drilling and foundry uses. Harry T. Thorson is president of this company, and associated with him as general manager is A. C. Harding.

Iverson Names New Sales Manager

Ed Robertson has been appointed sales manager for Iverson Tool Co., Tulsa, effective April 15. For the past 3 years he has been district sales manager for Jones & Laughlin in Kansas and resided at Wichita. Robertson will make his home in Tulsa and will office in the headquarters of the company.

Cardwell Moves Tulsa Office

H. F. (Mike) Ryan, Oklahoma representative, Cardwell Manufacturing Co., has moved his Tulsa office from 10 East Fourth Street to 1423 Hunt Building.

Sedberry Resigns

T. D. (Dick) Sedberry has resigned as secretary-treasurer and general sales manager of Pelican Well Tool & Supply Co., Shreveport, and will no longer be actively associated with the business.

Weco Expands Sales Territory

As part of an expanded sales and service program at Well Equipment Manufacturing Corp., Houston, S. W. Lomax and H. A. (Al) Ferguson were recently given new sales assignments. Lomax will work out of Houston and cover the Gulf Coast area. Ferguson will cover the Eastern Louisiana, Southern Mississippi, Alabama, and Florida areas. He will make his headquarters at Gulfport, Miss.

Reed Acquires "Cleco" Pneumatic Tool Line

Reed Roller Bit Co. announces that it has purchased the pneumatic-tool line of products from Cleveland Pneumatic Tool Co., Cleveland. The inventories of raw material, semifinished stock, finished stock, and machine tools will be moved to Houston.

Reed will manufacture the products in a plant at 4600 Clinton drive. Included with the purchases was the trademark "Cleco" and the right to use this name in foreign countries as well as in the United States.

Marsh Promoted in National Tube

F. A. MARSH

Forrest A. Marsh, for 8 years National Tube Co.'s division sales manager at Houston, has been appointed assistant to the vice president in charge of sales for the company. The appointment was announced by W. F. McConnor, vice president in charge of sales of this U. S. Steel subsidiary. Marsh succeeds James B. Graham, who is retiring. The retirement of Karl P. Neilsen, founder of Neilson Pump Co., Long Beach, Calif., and promotion of R. F. Baker to manager of the organization have also been announced.

Dayton Rubber Changes Name

Dayton Rubber Manufacturing Co., Dayton, announces the change of its corporate name to The Dayton Rubber Co. The change was made effective April 1 by the stockholders and board of directors of the company.

Continental Supply Adds Two

Continental Supply Co., Dallas, has announced appointment of two additions to the organization's supervisory personnel.

B. L. HINDMAN

R. HORTENSTINE

B. L. Hindman has been named assistant district manager in charge of operations at Laurel, Brookhaven, Natchez, and Jackson, Miss., and Jena, La. His headquarters are at Brookhaven. Raleigh Hortenstine, Jr., is now assistant district manager for the area made up of Baton Rouge, New Orleans, Houma, New Iberia, Eunice, and Lake Charles, La., with headquarters at New Iberia.

Weatherford Spring Turns to Air

Frequent shipments of reversible scratchers and spiral centralizers are being air expressed to operators in South America in an effort to eliminate high-cost squeeze jobs, according to officials of Weatherford Spring Co., Weatherford, Tex., manufacturers of the tools. Cementing problems in Venezuelan completions, like those in the Gulf Coast area, include many failures and delays. Saving in rig time made possible by the scratchers and centralizers has been found to more than compensate for the high transportation costs, company officials said.

Gibson Joins Braun & Co.

George Gibson has joined C. F. Braun & Co., oil-refinery engineers and contractors, as a district engineer. At present Gibson is in California and will return to New York about June 1. During the war, Gibson worked in the construction section of Petroleum Administration for War. Recently he completed a job for Hoover, Curtice & Ruby and since then has been on Bahrein Island for the U. S. Government.

New display rooms of Stewart & Stevenson Services fronts a fireproof building which houses offices, parts department, and the engine-manufacturing division of the company. The new buildings, which cover more than a square block, are located at 4516 Harrisburg Boulevard, Houston

Youngstown Appoints Christopher and Owings

Youngstown Sheet & Tube Co. announces the appointment, effective April 1, of G. W. Christopher as manager of standard pipe

G. CHRISTOPHER

J. W. OWINGS

sales, and J. W. Owings as manager of oil-country tubular sales. Their headquarters will be in the company home offices in Youngstown.

International Harvester Branch Management Changes

International Harvester Co. has announced the following changes in branch management: W. F. Schaeffer, formerly retail motor-truck manager at Shreveport, has been appointed assistant manager at that branch. M. R. McClure, formerly sales promotion man at Fort Dodge, Iowa, has been appointed assistant manager at that branch. H. T. Rosell, formerly retail motor-truck manager at Wichita, has been appointed assistant manager at the Dallas motor-truck branch. R. G. Walls, formerly retail motor-truck manager at Atlanta, has been appointed assistant manager at the New Orleans motor-truck branch. G. B. Healey, formerly retail manager at Eau Claire, Wis., has been appointed assistant manager at the Davenport motor-truck branch. J. D. Richardson, formerly assistant manager at Omaha, has been appointed manager of the newly established Omaha motor-truck branch.

Hood and Morrissey District Managers

Ken O. Hood is the new Pacific Coast district manager for Falk Corp., Milwaukee, it is announced by Walter Schneider, vice president in charge of sales. With headquarters in Los Angeles, he will direct sales in California, Washington, Oregon, Nevada, New Mexico, Arizona, Colorado, Utah, Idaho, and parts of Wyoming. Returning to the Cincinnati post after an absence of 4 years which he spent at the home office on special assignment during the war is Kenneth W. Morissey. Before becoming district manager of Cincinnati, he was in the Los Angeles and Pittsburgh sales district. He has been with Falk since 1928.

Three Added in du Pont

Hugh Fairclough, formerly with Dow Chemical Co. at Midland, Mich., has joined the hydrocarbon engineering section, engineering department, E. I. du Pont de Nemours & Co., Inc. Dr. James E. Evans, who was formerly associated with Houdry Process Corp. at Marcus Hook, Pa., is now with the hydrocarbon engineering section, design division. James W. Walker, formerly with The Lummus Co., New York City, is now associated with the engineering department, hydrocarbon engineering section. All will be located at Wilmington.

Miller Visits New York

George Miller, president of Oil Base, Inc., Los Angeles, attended the recent A.I.M.E. annual meeting in New York City where he presented a paper on oil-base drilling fluids. On his return to the West Coast he visited the company's new plant in Wynnewood, Okla., where waterless drilling fluid is being manufactured for the Mid-Continent area. In Texas he visited the site for a new plant to be erected in Houston to serve the Gulf Coast area.

Thornhill and Senter Head Nomads Board of Regents

Charles W. Thornhill of Thornhill-Craver Co., and Floyd L. Senter of the National Tank Co., have been named president and secretary-treasurer, respectively, of the National Board of Regents of the Nomads for the ensuing year. Both new officers are charter members of the Houston Chapter.

Guinn Transferred in Mid-Continent Supply

Ken W. Davis, president of Mid-Continent Supply Co., announces the transfer and promotion of C. V. Guinn, district service manager at Oklahoma City, to the new post of general service manager for the entire organization. Guinn will operate out of the company's general offices in Fort Worth.

The First National Bank of Fort Worth recently elected Ken W. Davis, president of Mid-Continent Supply Co., as a director.

Allan Edwards, Inc., Is Formed

Allan J. "Scotty" Edwards, copartner in the firm of M. F. Hampton & Co., dealers in pipe-line and oil-field equipment and supplies, has purchased the partnership to create Allan Edwards, Inc. The new corporation will continue to handle the same line of pipe-line and oil-field equipment and supplies as formerly, retaining the same offices in the McBirney Building in Tulsa. Edwards is widely known in oil circles, having been actively engaged in the oil-field-supply business for the past 25 years. For some 20 years he was associated with Black, Sivalls & Bryson. A major portion of the time he was with that firm he was general sales manager.

Gilmore and House Transferred

H. G. Gilmore, field representative in the Artesia, N. M., area, was recently appointed store manager and field representative at the Artesia store of Bethlehem Supply Co. to succeed F. E. Smith. W. B. House, field representative at Houston, has been transferred to Eunice, La., as field representative in that area.

Nelson Chicago Manager

Roland E. Nelson has been appointed manager of the Chicago office of H. K. Porter Co., Inc., it is announced by W. W. Calihan, director of sales. Nelson, who succeeds George L. Green, was associated with J. P. Devine Manufacturing Co. for several years in an engineering capacity prior to its acquisition by the Porter organization.

Rappart Returns to France

Henri Rappart, Colombian operations manager for Schlumberger Well Surveying Corp., will leave Bogota shortly for a 3-month vacation, returning to France via New York with his family. Raymond Sauvage is scheduled to arrive in Bogota and be in charge meanwhile. Sauvage was interned in a Japanese concentration camp during the war and recently has been working in Venezuela.

Schaefer President of Gardner-Denver

E. F. SCHAEFER

Edgar F. Schaefer, executive vice president of Gardner-Denver Co., was elected company president, and H. G. Myers, former president, became chairman of the executive board at the annual stockholders meeting held March 28 at Quincy, Ill. In assuming chairmanship of the executive committee. Myers takes the post formerly held by the late J. W. Gardner, and in this capacity will be actively associated with the affairs of the company.

Schneider and Reinhardt In New Positions

Wheelco Instruments Co., Chicago, announces the election of Elmer Schneider to a newly created position, vice president and director of engineering. In this capacity, Schneider will take complete charge of all engineering activities of the company including inspection and approval of quality standards. Joseph A. Reinhardt will become plant manager and assume responsibility for all manufacturing operations.

Hale in Venezuela For A-1 Bit & Tool

Jack Hale, side-wall coring expert of A-1 Bit & Tool Co., Houston, will leave soon for Venezuela and Colombia, where he will give instruction in side-wall coring. C. B. McDonald, sales manager, has just returned from a business trip to Mexico City. Jimmy Douglas, Mexico representative for the company, is now in Houston and plans to return to Mexico soon.

Jenkins Brothers Elects New Officers

Alfred J. Yardley has been elected president of Jenkins Brothers, manufacturers of valves, succeeding his father, Farnham Yardley, who becomes chairman of the board, after serving as president for the past 30 years. The company also has announced the election of James L. Dunn, vice president in charge of industrial relations, and C. C. Chamberlain, general sales manager, to the board of directors.

Burch Speaks in Drumright

J. Gordon Burch, president of Burch Agate Torpedo Co., Borger, Tex., was the principal speaker at the April meeting of the Drumright chapter of the A.P.I. in Drumright, Okla., April 14. Burch had recently presented his program, "The Marble Shot—Its Use, Adaptation, and Success," at the A.P.I. annual spring meeting held in Pittsburgh.

Coon in Central America

G. D. Coon, manager of the export division of Gamble-Skogmo, Inc., Minneapolis, began an extended buying and market-survey trip to Mexico and Central America in February. Coon will spend most of his time in the Central American republics, as well as principal cities of Mexico, contacting with representatives and distributors of the company.

Estes Joins A-1 Bit & Tool

Harry Estes has joined A-1 Bit & Tool Co., Houston, as assistant to the president. Estes was with Reed Roller Bit Co. for 18 years prior to this change.

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The Market Place for the Oil Industry

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All ads except Situations Wanted. 10 cents a word. Minimum charge, $2.00 per insertion.
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THE OIL AND GAS JOURNAL
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EQUIPMENT FOR SALE

SPUDDER—Fort Worth Spudder D located on siding in Tulsa. Travco Equipment Co., 110 Midco Bldg., Tulsa, Oklahoma. Phone 5-2251.

FOR CABLE TOOLS
see
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

LUMBER FOR SALE: 3x6 and wider 10 to 16 rough Oak $58.00 f.o.b. mill. E. J. Gaiennie, Lumber, Box 1074, Shreveport, Louisiana.

WELL DRILLING Machines, Spudders, Core drills, Standards. Complete stock cable tools. Used equipment reconditioned. Some Government surplus. Pressey & Son, Pueblo, Colorado.

FOR SALE: Pumping Units. All types & sizes. New and used. Bridgeports, Jensens, Americans, Atlas, Ideco, with or without Power. Glenn Supply Co., 3600 Sand Springs Road. Phone 3-9607, Tulsa, Okla.

FOR SALE: Double drum Dietle casing puller with Fordson power, 50′ mast and tools. Also pole trailer and float. R. S. Hanson, 5454 N. Broadway, Phone 4-4862, Box 2102, Kansas City, Kansas.

FOR SALE: 6—5,000 bbl. New A.P.I. Bolted steel tanks. 7—10,000 bbl. New A.P.I. bolted steel tanks. Also 1,000 bbl., 500 bbl. new A.P.I. steel tanks. New and used grain tanks. Welded steel tanks. Independent Tank Mfg. Co., Seminole, Oklahoma. Phone 977.

EQUIPMENT FOR SALE

FOR SALE: Six New Kobe, 2½ inch tubing insert, pumps, one Triplex—Bargain for immediate sale. Ben Beckham, Jr., Box 134, Overton, Texas. Phone 3921.

FOR SALE: One 7¼ x 10″ and one 7¼ x 14″ Gardner Denver pumps—overhauled—good condition. Also, one 82 CFT Gardner Denver Air Compressor. Drillers Machine Shop, Box 4532, Oklahoma City 9, Okla., Phone 6-3281.

FOR SALE: One Wilson Super Spudder, powered by completely reconditioned PA-100 motor, complete with mast and 5,000-ft. drilling and sand line. Located at Plainville, Kansas. Phone 1338, Hays, Kansas. Price $7500.00.

FOR SALE: 10,000 Ft. Used 2⅞″ O.D. E.U.E. 6.50 Weight, Range 2, Grade H-40, 10 Thread Seamless Tubing 10,000 Ft. Used ¾″ A.P.I. Axelson No. 59 pin and pin Sucker Rods. Price tubing and rods combined, fifty cents per foot.
Box 778, Ardmore, Oklahoma.

FOR SALE

12—230 H. P. Bessemer and Clark horizontal Engines with new 17″ Power Heads complete with compressors in first-class condition.

ENGLE PETROLEUM, INC.
P. O. Box 72
MT. CARMEL, ILLINOIS

New and Used
VALVES and FITTINGS
VICTORY SUPPLY COMPANY
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FOR SALE
STEEL STORAGE TANKS
63—10,000 Gallon Capacity Tank Car Tanks
CLEANED PAINTED TESTED
Located in Oklahoma
IRON & STEEL PRODUCTS, INC.
42 years' experience
13412 S. Brainard Avenue
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"ANYTHING containing IRON or STEEL"

EQUIPMENT FOR SALE

NEW 200-A Sullivan Core Drill—Truck mounted. Box B-674, The Oil and Gas Journal, Tulsa, Oklahoma.

USED SHOT HOLE DRILLS
These drills are mounted on trucks and vary in size and in condition. May be seen at 8806 Lemmon Avenue, Dallas, Texas. Phone Dixon 4-2671.

OILFIELD TANDEM TRUCKS
Whites-International-Macks-Misc. full rigged for oilfield work or ideal for mounting heavy units or rigs. G. G. Clayton, Houston, Texas, P.O. Box 1671. Telephone Keystone 3-1361.

FOR SALE: 1—Model RL-194 Cardwell spudder, complete with 5″ and 6″ tools, wire lines, light plant, tool house, and derrick-type mast. Also 1—RL Cardwell spudder with "A" frame mast. Box 1388, Phone 306, Seminole, Oklahoma.

FOR SALE: 1—14″ x 14″ Ideal horizontal twin cylinder steam drilling engine. 2—15½″ x 8½″ x 20″ Ideal steam slush pumps. Excellent condition. Priced right.
Lucey Products Corporation,
Tulsa, Oklahoma.

WIRE ROPE
Brand New—On Original Reels
450,000 Ft. Hemp Center
254,400 ft.—¼″—6x7 High Grade Plow Steel Galv. Preformed.
160,000 ft.—¾″—6x37 Improved Plow Steel Preformed.
15,000 ft.—⅞″—6x12 Plow Steel Galvanized.
6,000 ft.—1¼″—6x37 Plow Steel Galvanized.
19,000 ft.—1¼″—6x37 Plow Steel.
Manufactured by the Nation's leading wire rope companies.
Save up to 50%.
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FOR SALE
TUBES and PIPE
all types and sizes
Write, wire or phone for quotations. Also motors, machinery and kindred items.
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HYDRAULIC PUMPS

Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2¾″ x 8″, equipped with Herringbone gears, 67.5 GPM. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate.

Motors are 75 HP, 3/60/220-440 volts, 1740 RPM. Complete with starting panel, consisting of G.E. motor starter switch, push button control, square "D" Switch, and capacitator.

Purchased new 3½ years ago. Excellent condition. Available for immediate delivery.

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One—3″ Pacific Hot Oil Pump, ten stage, direct connected to 600 H.P. 3 stage, G. E. Steam Turbine.
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One—30 x 7 x 20 Burnham Twin Simplex Hot Oil Pump.
1,975 Ft.—3¼ I.D. x 4½″ O.D. Tubing, 4-6 Chrome—in 25-ft. lengths, plain end.
One—Fractionating Tower, 6 ft. x 39 ft. x ⅜″ shell—20 steel bubble trays.
Two—5 ft. x 30 ft. Pressure Vessels, lined with lead and acid resisting brick.
Pressure vessels to 30,000 gals. capacity, Centrifugal and Reciprocating Pumps, Heat Exchangers, Valves.

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The OIL AND GAS JOURNAL

FOR LIGHT WEIGHT DRILLING

FOR HEAVY WEIGHT DRILLING

CHOOSE HUGHES

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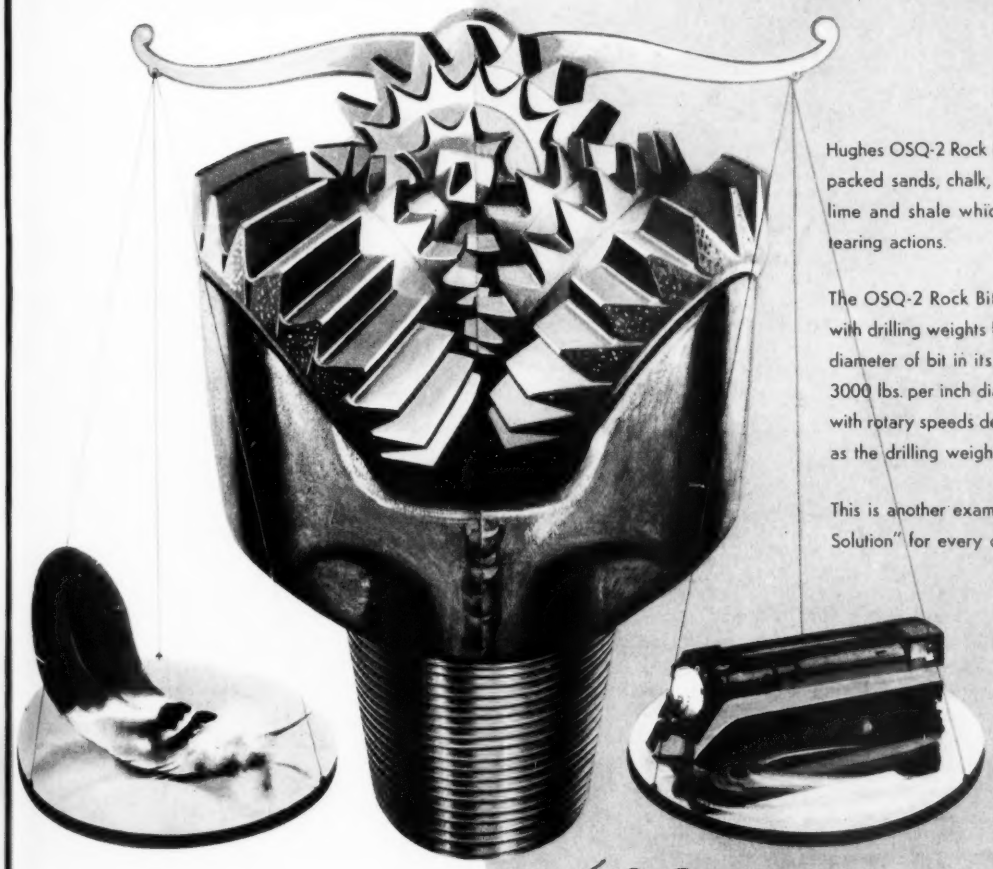

Hughes OSQ-2 Rock Bit is "tailor-made" for drilling packed sands, chalk, anhydrite, and medium hard lime and shale which respond to chipping and tearing actions.

The OSQ-2 Rock Bit will generally perform best with drilling weights from 775 to 1000 lbs. per inch diameter of bit in its early life to a maximum of 3000 lbs. per inch diameter of bit when well worn, with rotary speeds decreasing from 150 to 75 R.P.M. as the drilling weight is increased.

This is another example of a Hughes "Engineered Solution" for every drilling problem!

Hughes TOOL COMPANY
HOUSTON, TEXAS
Standard of the Industry

PRICE 20 CENTS

TABLE OF CONTENTS PAGE 37

MAY 10, 1947

the VAPORSPHERE

PATENTS APPLIED FOR

. . . . A HORTON PRODUCT DESIGNED TO PREVENT EVAPORATION LOSS FROM ONE OR MORE FIXED-ROOF TANKS STORING CRUDE OIL OR GASOLINE

THE Vaporsphere consists of a spherical steel shell and a flexible hemispherical membrane, the outer edge of which is connected to the inside of the shell at the equator. The Vaporsphere is connected to the vapor spaces of the fixed roof tanks by large-diameter piping. Vapor forced out of the tanks by breathing, due to increasing temperature, or by unbalanced filling and emptying, flows through the piping into the Vaporsphere. These vapors which ordinarily would be vented to the atmosphere and lost are thus confined to the vapor-saving system and returned to the tanks when the conditions which caused their displacement are reversed.

A Vaporsphere can be connected to a group of storage tanks without taking them out of service. Additional tanks may be connected to the system at any time (providing the Vaporsphere has sufficient capacity to take care of them). The Vaporsphere is dependable. It has no complicated control mechanisms to get out of order and it operates automatically by natural forces thereby eliminating operating costs aside from ordinary maintenance.

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Table of Contents

NEWS DEVELOPMENTS

Foreign Oil Vs. Self-Sufficiency Debated at Chamber Meeting 40
Aid for Foreign Operations Asked by U. S. Chamber 40
Amendments Action Premature, FPC Chairman Testifies 41
Jersey Standard Denies Statements in Farben Indictment 42
Stone Oil's Refinery Partially Reopened 42
Champlin Buys 46 Wells; Other Deals Closed 42
Texas Will Have 69 Gas-Conservation Plants 44
Chinese Hold Meager Production Despite Old Equipment 48
Two New Refineries to Open in Australia 49
Nine Technical Papers on Los Angeles Program 50
Exclusive-Dealer Suit Filed Against Richfield 50
Continued Growth of Gas Industry Indicated, A.G.A. Told 53

Editorial 39 — Natural-Gas News 109
This Week 43 — Natural-Gasoline News 109
International News 46 — Refining News 111
Watching Washington 56 — Pipe-Line News 115

ENGINEERING AND OPERATING

Specially Designed Workover Barges Meet Many Requirements 62
Effect of Temperature in Thermal Catalytic Cracking 64
Is Corrosion Taking $ $ From Your Pocket? 68
Sound Methods Assure Steam-Power-Plant Efficiency 72
Well Completion and Remedial Work With Plastics 76
Natural Gas Potentially Rich Source of Synthetics 80
Questions on Technology 84
Oil Production by Water—Part 20 (Final) of a Series 87
Electronic Micrometer Is Exceedingly Accurate 93
Modern Rotary Drilling—No. 19 in a Series 97
The Refiner's Notebook—No. 143 in a Series 99
Engineering Fundamentals—No. 285 in a Series 101
Oil and Gas Equipment Digest 103

EXPLORATION AND DRILLING

Oklahoma Area Getting Hotter 119
Reports by Areas Start on Page 119
Daily Average Production for Week 140
Daily Well-Completion Record 141

ADDITIONAL FEATURES

Personals 59 — Equipment Men in News 144
Deaths in the Industry 61 — Classified Advertising 146
Drilling Contractors 137 — Events on the Calendar 150
Market Summary 142 — Advertisers' Index 150